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# CALIFORNIA LANDING FLOODING FEBRUARY 3, 1998

## Flooding Evaluation Study

**Prepared for:**
**City of Milpitas**
**Santa Clara Valley Water District**

**August 26, 1998**

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**Re: California Landing Flooding, February 3, 1998**

Gentlemen:

Schaaf & Wheeler is pleased to submit the enclosed Flooding Evaluation Study which presents the results of our evaluation of the February 3, 1998 flooding in the California Landing area in the City of Milpitas.

The objective of the study is to document information concerning the flood event and rainfall, investigate the history of drainage and flood control improvements in the area, and evaluate the causes of the flooding.

If you have any questions, or require additional information, please call me.

Sincerely,
SCHAAF & WHEELER

Kirk R. Wheeler, PE
Principal

REGISTERED PROFESSIONAL ENGINEER
KIRK R. WHEELER
No. 30995
Exp. 3-31-00
CIVIL
STATE OF CALIFORNIA

# Executive Summary
# California Landing Flooding Evaluation
# February 3, 1998 Storm

## Introduction

Schaaf & Wheeler was retained by the City of Milpitas and the Santa Clara Valley Water District (District) to investigate the flooding from the February 3, 1998 storm event which flooded the California Landing area in the City of Milpitas. The objective of the study is to document information concerning the flood event and rainfall, investigate the history of drainage and flood control improvements in the area, and evaluate the causes of the flooding.

## Flood Description

The California Landing flooding occurred in the early hours of February 3, 1998. The maximum rainfall occurred near midnight. By 2:30 am there was extensive flooding in Dixon Landing Park, the apartment complex north of the park, and the subdivision west and south of the park.

The Jurgens Pump Station, which drains the area, failed during the storm. The City installed portable pumps to drain the area on February 3, 1998. The pump station was in partial operation with one pump on February 3, and all four pumps on February 5. The system was operated by hand for three weeks until control system repairs were completed.

On February 3, a low point was observed next to the SPRR tracks at the confluence of Calera Creek and Berryessa Creek. Berryessa Creek had overflowed through the low point. Part of the overflow had scoured under the sound wall west of the railroad, into the California Landing area. The overflow from Berryessa Creek contributed to the local inflows from the drainage system at Jurgens Pump Station. After the flooding, the low point was sandbagged to raise the level of protection at the low point.

## February 3, 1998 Precipitation

The recorded rainfalls during the February 3, 1998 storm event were reviewed to determine the magnitude and rainfall intensities of the storm event. The rainfall records were used to evaluate whether the storm exceeded the design conditions for the storm drain system and Jurgens Pump Station, and to estimate the flow rates in the stream channels. The precipitation gauges in the San Jose/ Milpitas/Fremont area show relatively consistent 24-hour rainfalls for the February 3, 1998 storm, in the range of 2.5 to 3.0 inches.

Based on the rainfall statistics for the Milpitas gauge (which is within the watershed), the 1-hour, 2-hour, 3-hour, and 6-hour rainfall intensities are close a 10-year event. A 10-year event would have a 10 percent probability of being exceeded in any year. The Curtner Ranch gauge intensities are closer to a 5-year event. A 5-year event would have a 20 percent probability of being exceeded.

## Storm Reconstitution

A storm reconstitution was used to estimate the runoff flow rates for the February 3, 1998 storm event. The reconstitution was used to estimate the stream flows in the Berryessa Creek and Lower Penitencia Creek channels. There are no stream flow gauges in the watershed. The storm reconstitution was based on a rainfall runoff computer model, which estimates the watershed runoff from the physical parameters of the watershed and the rainfall. The estimated peak flow rate for Berryessa Creek downstream of the Calera Creek confluence is 3090 cubic feet per

second (cfs), at 1:15 am February 3,1998. The estimated peak flow rate for Lower Penitencia Creek downstream of the Berryessa Creek confluence is 3546 cfs, also at 1:15 am.

**Previous Flow Rate Estimates**

Based on the current Flood Insurance Study (FIS), the 10-year peak flow rate for Berryessa Creek is 1870 cfs. The 100-year peak flow rate for Berryessa Creek is 2730 cfs. The District has established design flow rates for Berryessa Creek. The current design discharge is 3200 cfs for the 10-year flood, and 5600 cfs for the 100-year (1 percent ) flood. The Flood Insurance Study flow rates are intended to represent existing conditions and consider existing channel capacities and overflows. The District design discharges are intended for channel design purposes and assume channels with capacity for the 100-year design flows and do not consider potential overflows.

**High Water Marks**

Several high water marks were established after the February 3, 1998 storm. The high water marks were established based on mud or debris lines on fixed objects in the flooded area. The high water marks were surveyed to establish water surface elevations on a common survey datum.

**High Water Mark Elevations**
**February 3, 1998**

| LOCATION | ELEVATION (NGVD)* 1929 Datum | ELEVATION (NAVD)* 1988 Datum |
|---|---|---|
| Berryessa Creek at Calera Creek | 13.6 | 16.4 |
| SPRR 700' N of Berryessa Ck | 13.0 | 15.8 |
| Jurgens Pump Station | 11.0 | 13.8 |

* NGVD & NAVD - see page 9

Based on the field survey, the low point at Berryessa Creek levee on the west side of the SPRR is at elevation 10.3 feet NGVD (13.3 feet NAVD). Therefore, the maximum water surface elevation was 3.3 feet above the low point at Berryessa Creek.

**Hydraulics Reconstitution**

The peak flow rates from the February 3, 1998 storm reconstitution hydrology were used to reconstitute the channel hydraulics for Lower Penitencia Creek and Berryessa Creek using a step backwater computer model. The reconstitution hydraulics were used to evaluate the potential duration and volume of the overflow from Berryessa Creek at the low point near the SPRR. The estimated maximum water surface elevation for Berryessa Creek at the Calera Creek confluence was 12.0 feet NGVD (14.8 feet NAVD).

The high water mark elevation for Berryessa Creek at the Calera Creek confluence was 13.6 feet NGVD (16.4 feet NAVD). This was 1.6 feet higher than the estimated water surface elevation from the hydraulics reconstitution model and 0.8 feet higher than the FIS 100-year water surface elevation. There are several assumptions in the hydraulic model which may affect the estimated

water surface elevation. These include the channel flow rates, the starting water surface elevation at Coyote Creek, the channel roughness coefficients, and the channel cross sections.

**Jurgens Pump Station**

The Jurgens Pump Station was evaluated based on the estimated flow rates for the drainage system inflows and the overflow from Berryessa Creek. The inflows from the storm drain system were based on the hydrology reconstitution. The inflows from the creek overflow were based on the channel hydrograph from the hydrology reconstitution and the hydraulic conditions at the overflow and the sound wall. The evaluation was based on the pump station construction plans, observed conditions at the pump station, and maintenance staff recollections of the events during the February 3, 1998 storm.

Based on the reconstitution flow rates, the peak inflow from the local drainage area to the pump station was 298 cfs. The peak overflow from Berryessa Creek was 350 cfs. The combined peak inflow to the pump station was 530 cfs. The design capacity of the Jurgens Pump Station is 150 cfs. Flow in excess of the pump station capacity would pond in Dixon Landing Park. The park was designed to include detention storage as part of the pump station design.

The combined inflows from the local drainage system and the overflow from Berryessa Creek exceeded the capacity of the Jurgens pump station, and the detention storage in Dixon Landing Park. The pump station appears to have failed due to flooding of the control system.

Based on the estimated operation for the Jurgens Pump Station, the station would not have failed during the February 3, 1998 storm without the overflow from Berryessa Creek. The pump station floor would have flooded, but the maximum estimated water surface elevation would be 0.3 feet below the pump controls. The flooding would not have extended outside the Dixon Landing Park.

**Historic Improvements and Studies**

The District construction plans for the Berryessa Creek improvements in 1977 show the low point was filled as part of the levee project. The levee design extended to the SPRR fill, which is lower than the Berryessa Creek levee. The SPRR crossing at Calera Creek was not included in the Berryessa Creek project.

The Calera Creek improvements in 1980 included the SPRR crossing culverts. The construction plans did not include grading or structures to tie into the Berryessa Creek levees. The Calera Creek improvements were constructed as part of a development project. The plans were approved by the City and permits were issued for the improvements by the District.

The topography from the 1988 California Landing grading plans shows the low point at the Calera Creek confluence at elevation 10.2 feet NGVD. The levee was either not constructed as shown on the as-built construction plans, or the levee fill at the low point may have been removed at some time prior to1988.

The 1994 FEMA restudy for Berryessa Creek identified potential low areas in the levees. The District surveyed the levees and raised the levees to provide design freeboard. The low point in the Berryessa Creek levee at the Calera Creek confluence was not identified as a specific area which did not meet FEMA freeboard criteria.

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# California Landing Flooding Evaluation
# February 3, 1998 Storm

## Introduction

Schaaf & Wheeler was retained by the City of Milpitas and the Santa Clara Valley Water District to investigate the flooding from the February 3, 1998 storm event which flooded the California Landing area in the City of Milpitas.

The objective of the study is to document information concerning the flood event and rainfall, investigate the history of drainage and flood control improvements in the area, and evaluate the causes of the flooding.

The study also includes a reconstitution of the flood event using a rainfall runoff model to estimate a flood hydrograph for Calera Creek, Berryessa Creek, and Lower Penitencia Creek.

## Flood Description

The California Landing flooding occurred in the early hours of February 3, 1998. The maximum rainfall occurred near midnight. Based on observations by City of Milpitas staff, the Jurgens storm water pump station was operating with all four pumps at 11:30 pm February 2 and 12:30 am February 3. Between 2:00 and 2:30 am, Dixon Landing Park and the pump station were flooding. At that time one pump appeared to be operating. Staff tried twice to reach the pump station to assess the situation but were prevented by the flood water surrounding the station. The pump station stopped operation due to flooding. The flooding reached 3.7 feet deep within the pump station.

City of Milpitas and Preston Pipeline Company installed portable pumps at the site later in the day on February 3. The portable pumps removed the ponded water by the afternoon of February 3. Representatives of Caterpillar Motors arrived to assist with station repairs. The first pump was repaired and in operation on February 3. Two additional pumps were operational on February 4. The fourth pump was in operation on February 5. The pumps were operated by hand due to damage to the automatic control system. The pump station was staffed 24-hours a day for three weeks until parts were obtained for the control system to complete repairs.

On February 3, a low point was observed next to the SPRR tracks at the confluence of Calera Creek and Berryessa Creek. This is at the southeastern corner of the California Landing area. Santa Clara Valley Water District (District) and City crews started building a sandbag levee to close the low area on February 4. Teams worked until dark on February 4. Work resumed on February 5 with help from the San Jose Conservation Corps under the direction of the District. The sandbag wall was completed on February 6.

# California Landing Area Flood Plain

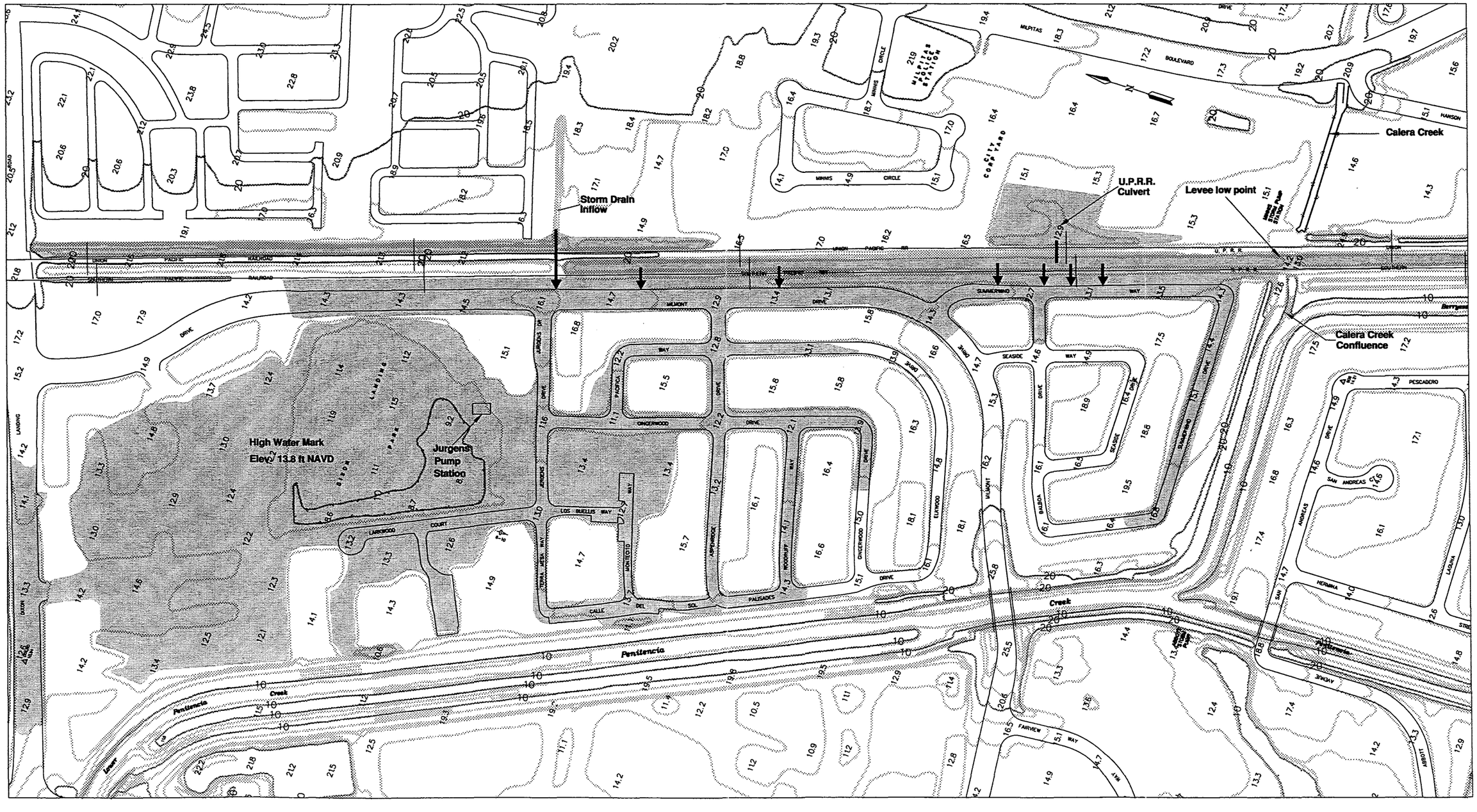
## February 3, 1998

Flooded area

Sound wall openings
Observed after event

1"=300'

DATUM: NAVD 88




FILE NAME:

Schaaf & Wheeler

The flooded area within the California Landing area is shown in Figure 1. The flooded area was estimated from video tapes of aerial observations on February 3 by the District, and field observations by City staff. The flood map was plotted on aerial survey topography from 1995. The estimated ponded water surface elevation within the California Landing area was approximately 13.8 feet based on the elevation datum of the topography (NAVD). The observed flooding in portions of the flooded area was higher than the ponded water surface elevation due to sheetflow along the streets. This includes flooding along Summerwind Way at the southern end of the California Landing area and along the railroad on the east side of the California Landing area.

**Existing Setting**

The California Landing area is located in northern Milpitas east of Highway 880. The area is bounded by Lower Penitencia Creek on the west, Dixon Landing Road on the north, The Southern Pacific Railroad (SPRR) on the east, and Berryessa Creek on the south. Berryessa Creek is a tributary to Lower Penitencia Creek. The confluence is located at the southwest corner of the California Landing area. Calera Creek, a tributary to Berryessa Creek, discharges to Berryessa Creek at the southeastern corner of the California Landing area, west of the SPRR. The Union Pacific Railroad (UPRR) is immediately east of the SPRR. The Calera Creek culverts upstream of the Berryessa Creek confluence cross under both the SPRR and UPRR. The UPRR was previously the Western Pacific Railroad (WPRR).

The stream channels for Lower Penitencia Creek and Berryessa Creek are improved flood control channels with levees higher than the California Landing area. The area is generally lower than the SPRR and Dixon Landing Road. Overflows from the streams or excess storm drainage cannot flow by gravity into the stream channels, but ponds in the lower areas within California Landing area in Dixon Landing Park. The lowest overflow point from the California Landing area is over Dixon Landing Road to the north. The low point on Dixon Landing Road is approximately 2 feet higher than the lowest street elevations in the California Landing area, and approximately 5 feet higher than the lowest elevations within Dixon Landing Park.

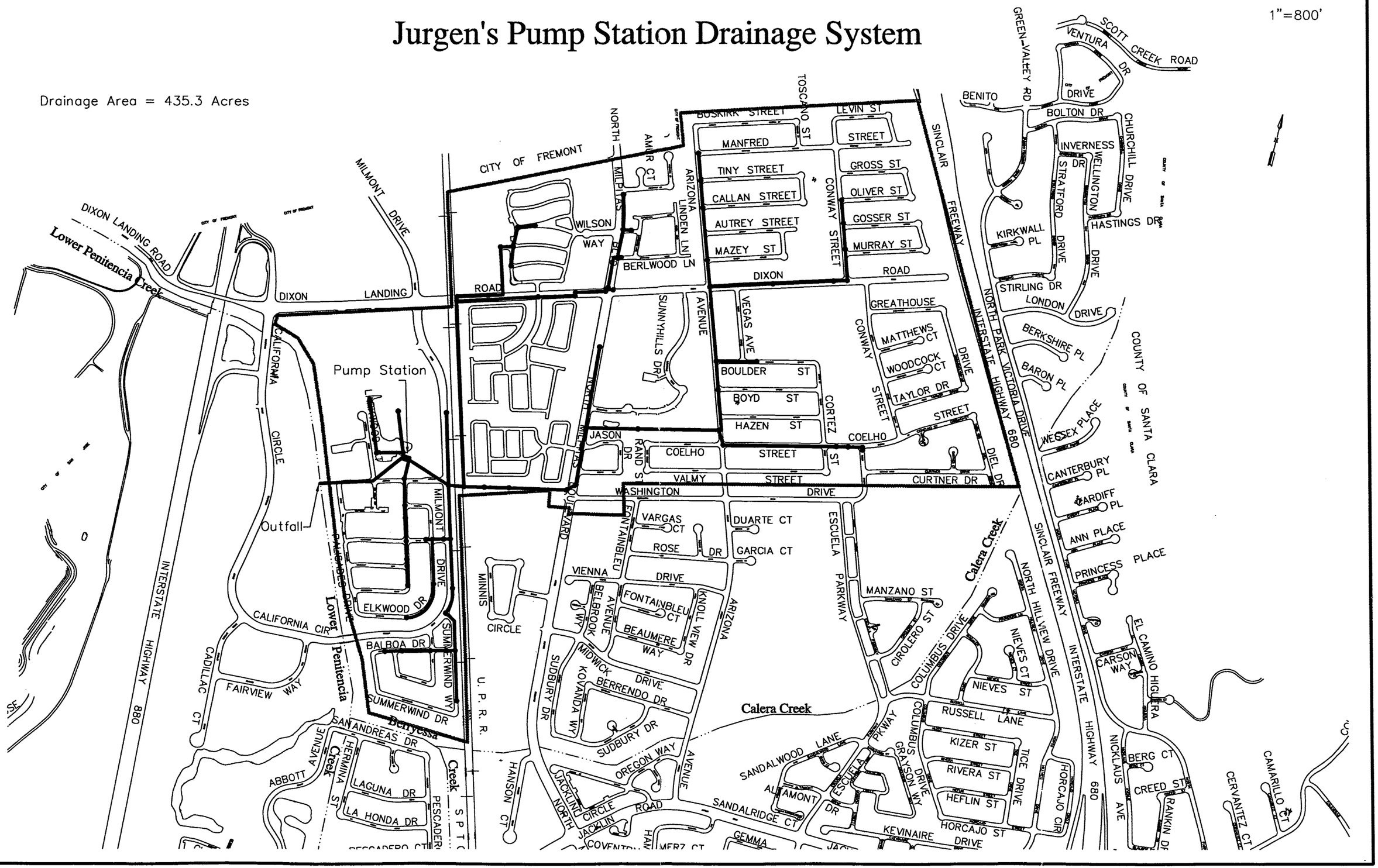
The California Landing area is served by a storm drain system which drains to a storm water pump station (Jurgens Pump Station) which discharges to Lower Penitencia Creek downstream of California Landing Circle. The drainage system also serves areas east of the SPRR, north and south of Dixon Landing Road. The storm drain system and drainage area are shown in Figure 2. The estimated drainage area is 435 acres. Approximately 96 acres of the drainage area is within the California Landing area west of the SPRR. The remaining 339 acres is upstream of the railroad.

The Jurgens Pump Station is located within Dixon Landing Park. The station includes four diesel engine driven pumps. The engines are 100 horsepower. Each pump has a rated capacity of 16,700 gallons per minute (gpm), 37.2 cubic feet per second, at a design discharge head of 8 feet. The station has a 72 inch inlet pipe and a 72 inch outlet pipe to the Lower Penitencia Creek outfall. Portions of the park area are lower than the streets, and storm water which exceeds the capacity of the pump station ponds in the park. The grading for the park was designed to provide

# Jurgen's Pump Station Drainage System

Drainage Area = 435.3 Acres

1"=800'




FILE NAME:

Schaaf & Wheeler

detention storage for the pump station for large storms. Based on the 1995 topography, the park area includes approximately 2 acre feet of storage below the pump station floor elevation.

**February 3, 1998 Precipitation**

The recorded rainfalls during the February 3, 1998 storm event were reviewed to determine the magnitude and rainfall intensities of the storm event. The rainfall records were used to evaluate whether the storm exceeded the design conditions for the storm drain system and Jurgens Pump Station, and to estimate the flow rates in the stream channels.

Precipitation gauge records for the February 3, 1998 storm event were obtained from the City, District, and Alameda County. The watershed for Lower Penitencia Creek and nearby precipitation gauge locations are shown in Figure 3. The rainfall accumulations for the period February 1 - 4, 1998 are shown in Figure 4. The Milpitas gauge is operated by the City. The Scott and Rancho Higuera gauges are operated by Alameda County. The Evergreen, Penitencia, San Jose, Guadalupe, Curtner, and Haskins gauges are operated by the District. The Scott gauge is located north of the Figure 3 map area, in Alameda County. The Evergreen gauge is located south of the Figure 3 map area in San Jose.

**Table 1**
**Recorded Precipitation**
**February 3, 1998 Storm**

| Precipitation Gauge | 24-hour Rainfall (in) | 36-hour Rainfall (in) |
|---|---|---|
| Milpitas | 3.03 | 3.47 |
| Scott | 2.01 | 2.33 |
| Rancho Higuera | 3.11 | 3.49 |
| Guadalupe Slough | 2.76 | 3.15 |
| Curtner Ranch | 2.89 | 3.28 |
| Penitencia | 0.63 | 1.02 |
| Haskins Ranch | 2.67 | 3.26 |
| San Jose | 2.56 | 3.03 |
| Evergreen | 2.01 | 2.05 |

Note: 24-hour Period - 12:00 pm 2/2/98 to 12:00 pm 2/3/98
36-hour Period - 12:00 am 2/2/98 to 12:00 pm 2/3/98

The highest rainfall totals were recorded at the Rancho Higuera, Milpitas, and Curtner Ranch gauges which are located in or near the northern portion of the Lower Penitencia Creek

# Lower Penitencia Creek Watershed

Scale: 1"=6000'

Rancho Higuera

Curtner Ranch
24hr Total = 2.89"
36hr Total = 3.28"

City of Milpitas
24hr Total = 3.03"
36hr Total = 3.47"

Guadalupe Slough
24hr Total = 2.76"
36hr Total = 3.15"

City of San Jose
24hr Total = 2.56"
36hr Total = 3.03"

Penitencia T. P.
24hr Total = 0.63"
36hr Total = 1.02"

Haskins Ranch
24hr Total = 2.67"
36hr Total = 3.26"

Coyote Creek
Scott Ck.
Calera Ck.
Dixon Landing Rd.
Ck. (No.)
Ck. (So.)
Tularcitos
Lower
Arroyo de Los Coches
Ford Ck.
Berryessa Ck.
Piedmont Ck.
Piedmont
Penitencia Ck.
Coyote Ck.
Landess Ave.
Berryessa Ck.
Sweigert Ck.
Crosley Ck.
Sierra Ck.
Rd.
Guadalupe Expwy.
Montague Expwy.
River
Berryessa Rd.
Coyote Ck.

880 680 237 101

## Legend

- Drainage Boundary
- Creek
- Highway
- Road
- Rainfall Gauge

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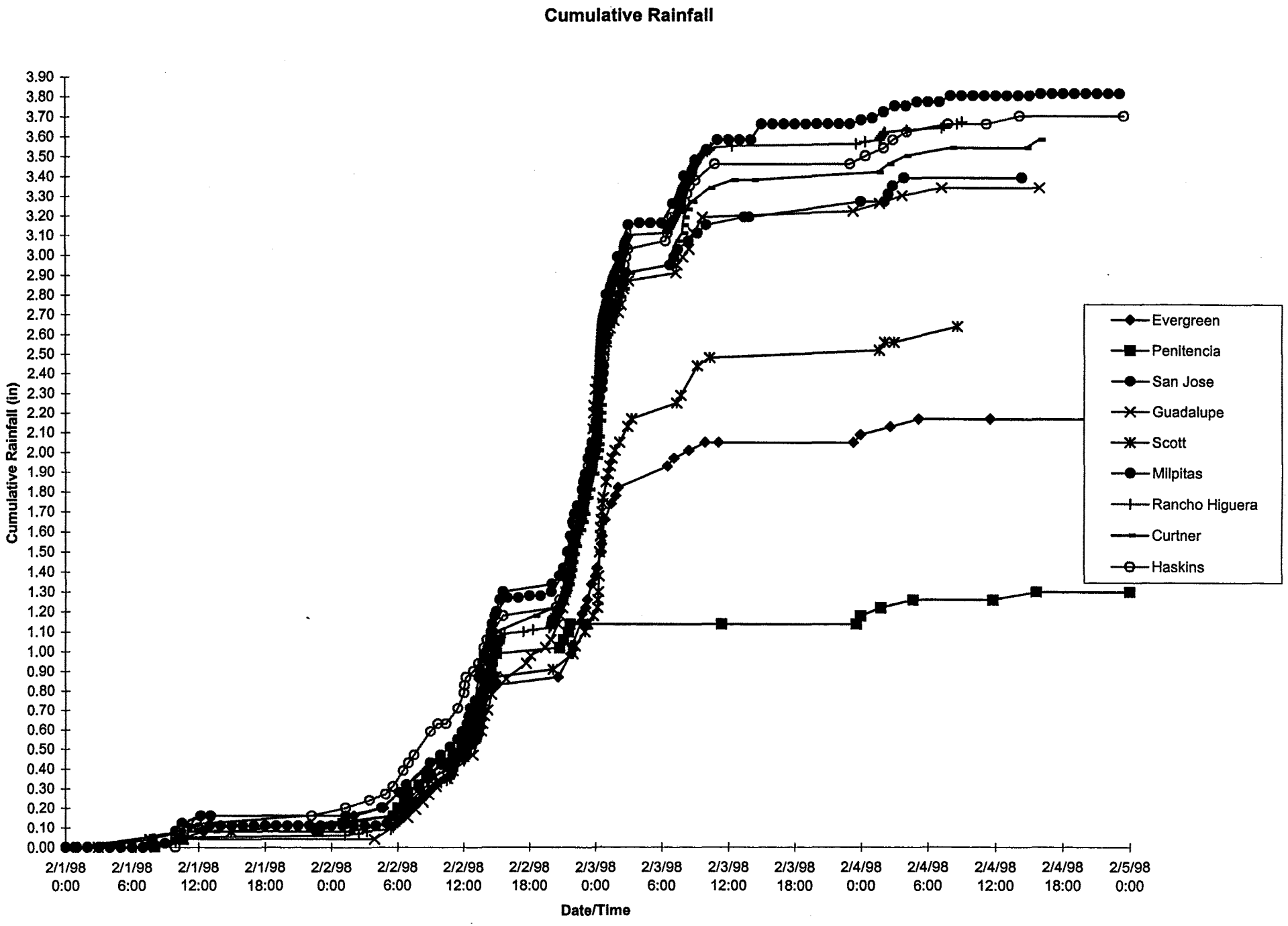

Cumulative Rainfall
Cumulative Rainfall (in)
3.90
3.80
3.70
3.60
3.50
3.40
3.30
3.20
3.10
3.00
2.90
2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
2/1/98 0:00
2/1/98 6:00
2/1/98 12:00
2/1/98 18:00
2/2/98 0:00
2/2/98 6:00
2/2/98 12:00
2/2/98 18:00
2/3/98 0:00
2/3/98 6:00
2/3/98 12:00
2/3/98 18:00
2/4/98 0:00
2/4/98 6:00
2/4/98 12:00
2/4/98 18:00
2/5/98 0:00
Date/Time
Evergreen
Penitencia
San Jose
Guadalupe
Scott
Milpitas
Rancho Higuera
Curtner
Haskins

FIGURE 4

watershed. The lowest rainfall totals were recorded at the Penitencia gauge, located south of the watershed, east of Highway 880.

The total rainfalls for the February 3, 1998 storm do not show a correlation with elevation. The higher gauges at Curtner Ranch (elevation 640 ft) and Haskins Ranch (elevation 2000) show similar rainfall totals to the lower gauges Milpitas (elevation 25 ft), Guadalupe Slough (elevation 7 ft), and San Jose (elevation 95 ft).

The Penitencia gauge recorded significantly lower rainfall totals than all the other surrounding rain gauges. The rain gauge is an Alert system gauge which reports by radio each 0.04 in of rainfall. The system includes a incremental counter which would identify missed radio event signals. District staff have not identified any problems with the gauge. However, there may have been an intermittent fault which affected the gauge on February 3.

**Rainfall Statistics**

Rainfall statistics for the individual rainfall gauges were used to evaluate the recurrence interval of the February 3, 1998 storm event. The recurrence interval is a measure of the probability of the storm. A 2-year storm would have a 50 percent probability of being exceeded in any year. A 10-year storm would have a 10 percent probability of being exceeded in any year. A 100-year storm would have a 1 percent probability of being exceeded in any year. Storm drains in the City of Milpitas are designed for a 10-year storm. The District normally designs flood control channels for the 100-year flood, also called the 1 percent flood event.

The recurrence interval of the February 3, 1998 storm event was estimated for the Milpitas, Guadalupe Slough, Curtner Ranch, Haskins Ranch, and San Jose rain gauge records for storm periods of 1, 2, 3, 6 and 12 hours.

The intensity-duration-frequency curves for the individual gauges were estimated based on rainfall data and the statistical procedures from the Department of Water Resources report, Rainfall Analysis for Drainage Design, Volume 1, Short-Duration Precipitation Frequency Data. The statistical procedure assumes a Log-Pearson statistical distribution. The mean for each duration interval was based on individual gauge statistics and regional ratios to the 24-hour rainfall. The standard deviation and skew was based on regional averages. The regional averages were used for standard deviation and skew because long term gauge records (more than 25 years) were considered necessary to accurately estimate the frequency variations. Only a limited number of gauges have long term records for short duration rainfall intervals (less than 24-hour periods).

Based on the statistical procedures, the estimated frequency a particular rainfall intensity at a particular gauge is related to the mean annual rainfall at the gauge and the regional standard deviation and skew. This means that, for example, the estimated 10-year 1-hour intensity would be greater at a gauge with an average annual rainfall of 20 inches than at a gauge with a mean annual rainfall of 15 inches.

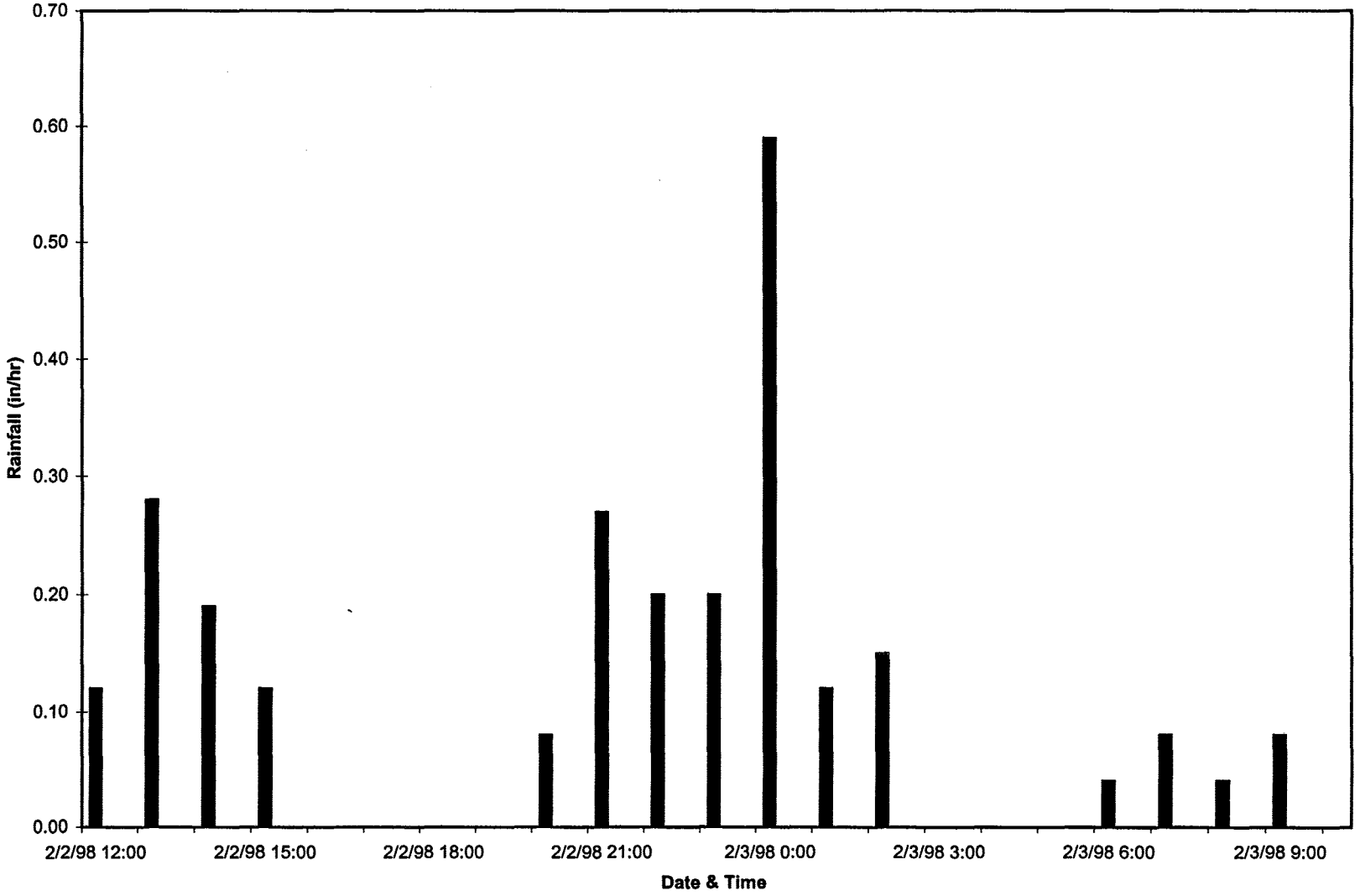

San Jose Rainfall
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Rainfall (in/hr)
2/2/98 12:00
2/2/98 15:00
2/2/98 18:00
2/2/98 21:00
2/3/98 0:00
2/3/98 3:00
2/3/98 6:00
2/3/98 9:00
Date & Time

FIGURE 5

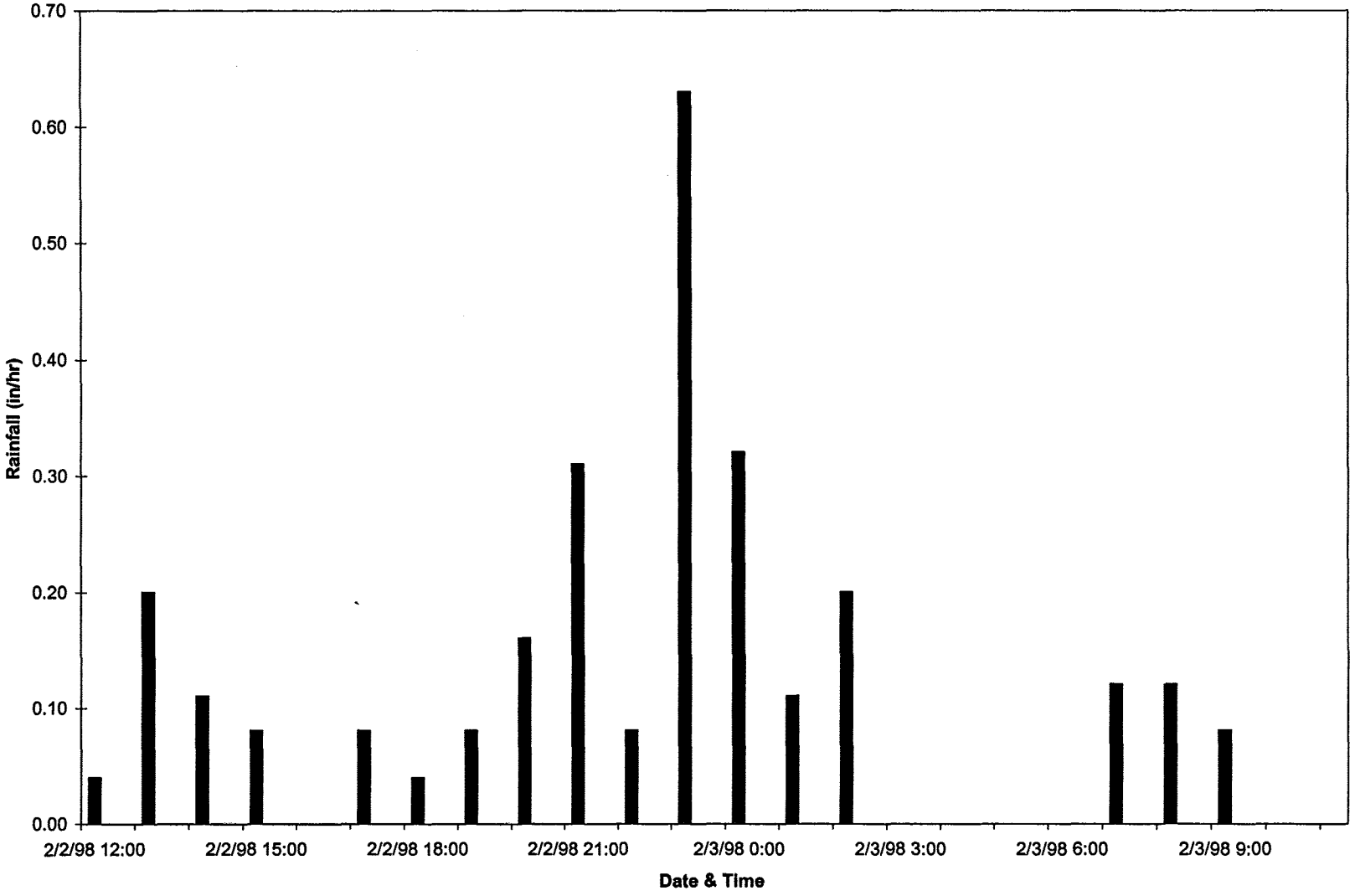

Guadalupe Slough Rainfall
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Rainfall (in/hr)
2/2/98 12:00
2/2/98 15:00
2/2/98 18:00
2/2/98 21:00
2/3/98 0:00
2/3/98 3:00
2/3/98 6:00
2/3/98 9:00
Date & Time

FIGURE 6

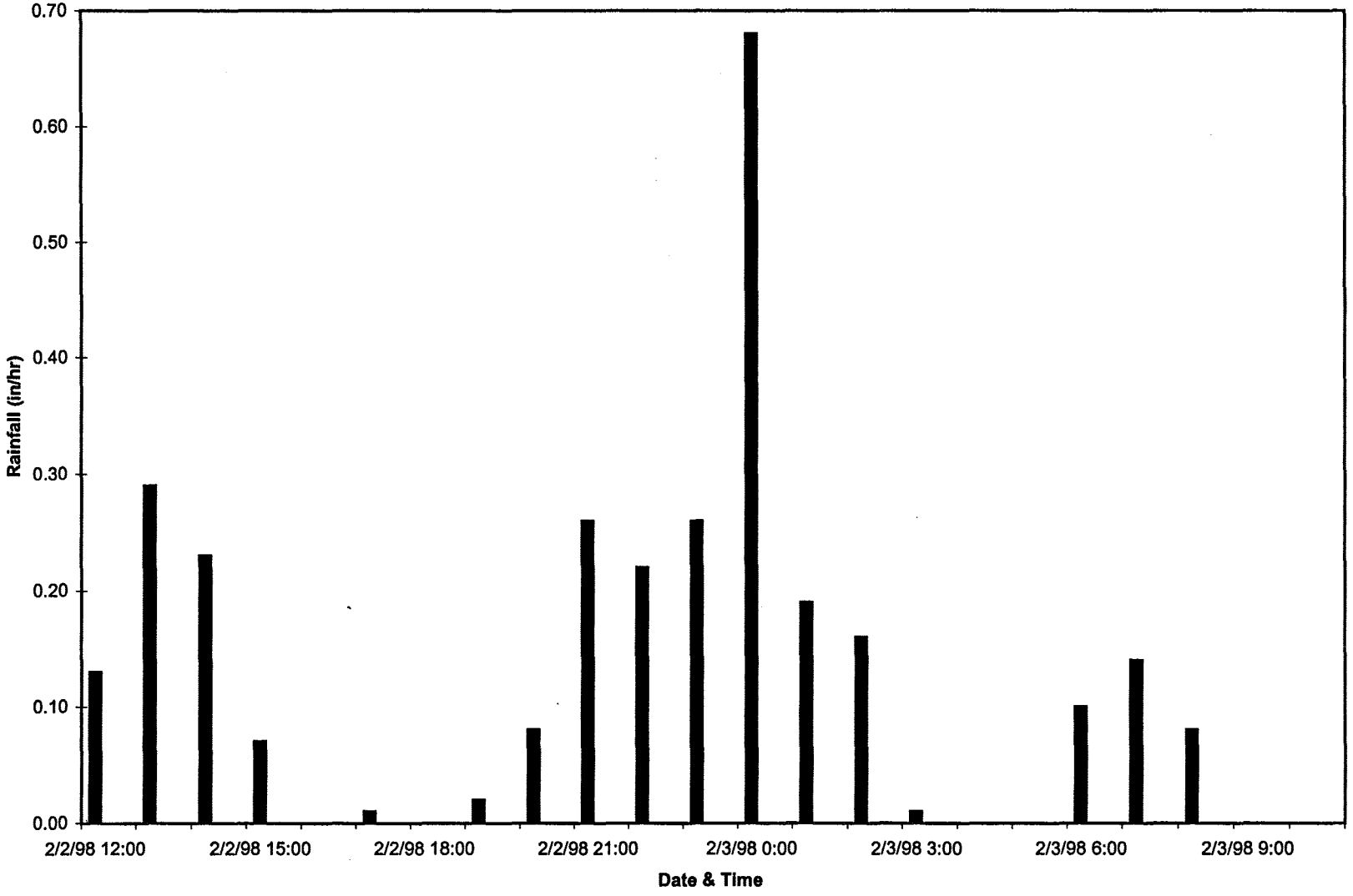

Mipitas Rainfall
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Rainfall (in/hr)
2/2/98 12:00
2/2/98 15:00
2/2/98 18:00
2/2/98 21:00
2/3/98 0:00
2/3/98 3:00
2/3/98 6:00
2/3/98 9:00
Date & Time

FIGURE 7

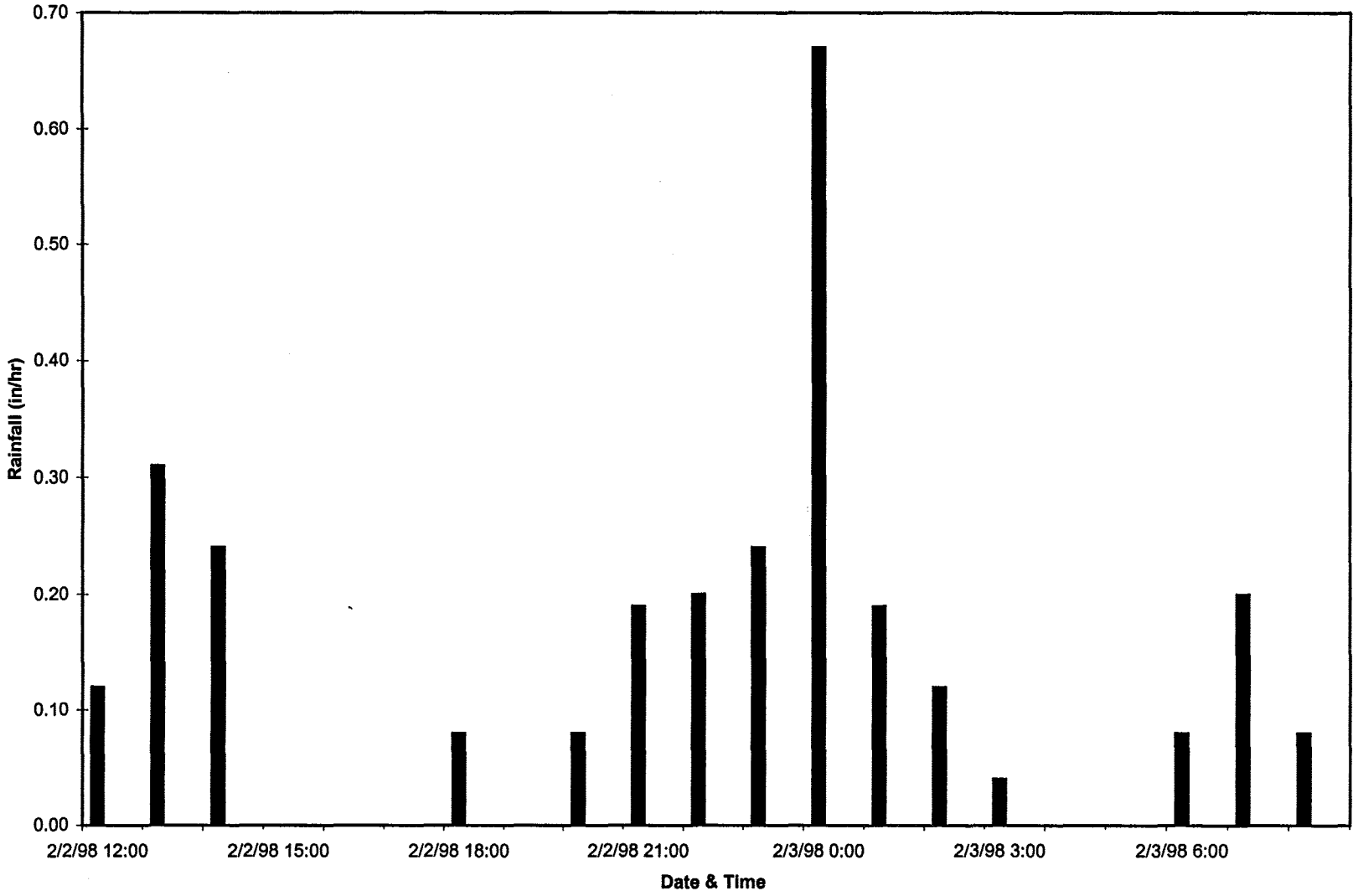

Curtner Rainfall
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Rainfall (in/hr)
2/2/98 12:00
2/2/98 15:00
2/2/98 18:00
2/2/98 21:00
2/3/98 0:00
2/3/98 3:00
2/3/98 6:00
Date & Time

FIGURE 8

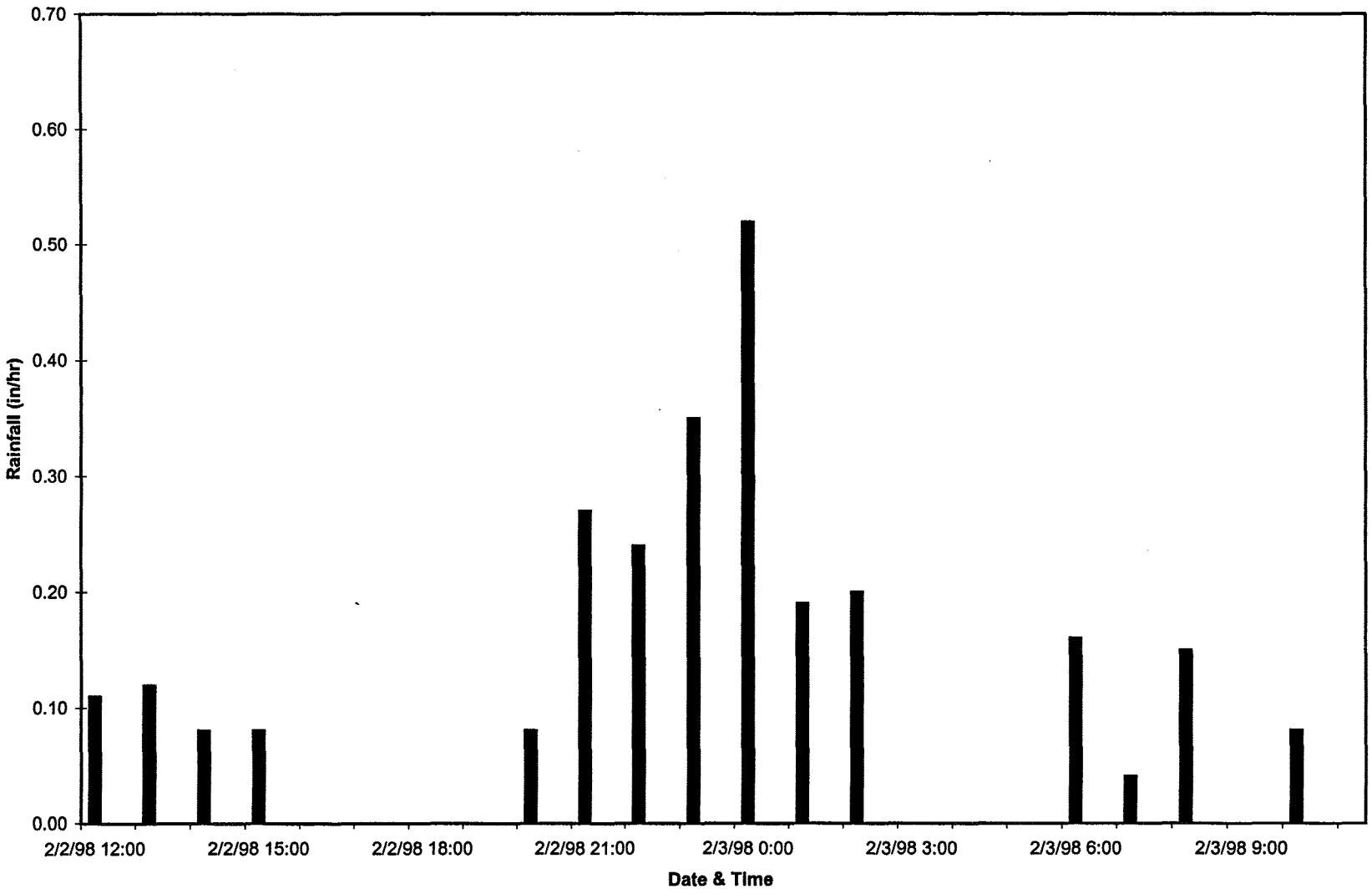

Haskins Ranch Rainfall
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Rainfall (in/hr)
2/2/98 12:00
2/2/98 15:00
2/2/98 18:00
2/2/98 21:00
2/3/98 0:00
2/3/98 3:00
2/3/98 6:00
2/3/98 9:00
Date & Time

FIGURE 9

The hourly rainfall totals for the February 3 storm are shown in Figures 5 to 9 for the rain gauges analyzed in detail. The storm intensity-duration data for each gauge are plotted in Figures 10 to 14, with the estimated intensity-duration-frequency curves for the individual gauges.

The duration of a particular storm event is considered significant because the peak flood flow from a particular watershed or drainage area depends on the lag time or time of concentration of the watershed. The time of concentration is a measure of the flow time it takes for the watershed runoff to reach the watershed outlet. If the rainfall duration is less than the time of concentration, runoff from the furthest portions of the watershed does not reach the outlet point before the end of the rainfall and the runoff from the nearest portions of the watershed would already have passed the outlet point. The rainfall duration must be at least as long as the time of concentration for the entire watershed to contribute to the peak flow at the outlet point. For longer duration storms, the rainfall intensity is lower than for shorter durations during the storm. Therefore, the critical duration rainfall is similar to the time of concentration and would result in the highest peak runoff flow rates. For the area of interest in Lower Penitencia and Berryessa Creek, the time of concentration ranges between 1 and 2 hours.

The estimated frequency of the February 3, 1998 storm varies at the individual rain gauges because the rainfall intensities at the individual rain gauges do not correspond to the mean annual precipitations at the gauges and the gauge statistics. For the Guadalupe Slough rain gauge, which has the lowest mean annual rainfall, the 1-hour rainfall intensity is 0.63 in/hr, which is between the 10-year and 25-year intensities. The 2-hour rainfall intensity is 0.48 in/hr which is greater than the 25-year intensity. For the Haskins Ranch rain gauge, which has the highest mean annual rainfall, the 1-hour rainfall intensity is 0.67 in/hr, which is below the 2-year intensity. The 2-hour intensity is 0.46 in/hr, which is also below the 2-year intensity.

For the two rain gauges within the Lower Penitencia Creek watershed, Milpitas and Curtner Ranch, the 1-hour and 2-hour recorded intensities are between the 5-year and 10-year intensities. The Curtner Ranch intensities are generally close to a 5-year storm. The Milpitas intensities are generally close to a 10-year storm. The February 3 storm intensities and frequency curves for the Milpitas and Curtner Ranch gauges are shown in Figures 12 and 13.

It should be noted that the gauge intensity-duration-frequency curves for the Milpitas and Curtner Ranch rain gauges are lower than the 10-year design values used for design of storm drain systems in the City. The design values were established over 20-years ago, and are intended to be conservative for design purposes.

**Storm Reconstitution**

A storm reconstitution was used to estimate the runoff flow rates for the February 3, 1998 storm event. The reconstitution was used to estimate the stream flows in the Berryessa Creek and Lower Penitencia Creek channels. There are no stream flow gauges in the watershed. The storm reconstitution was based on a rainfall runoff computer model, which estimates the watershed runoff from the physical parameters of the watershed and the rainfall. The results of the rainfall runoff model are hydrographs at particular locations within the watershed. A hydrograph is a

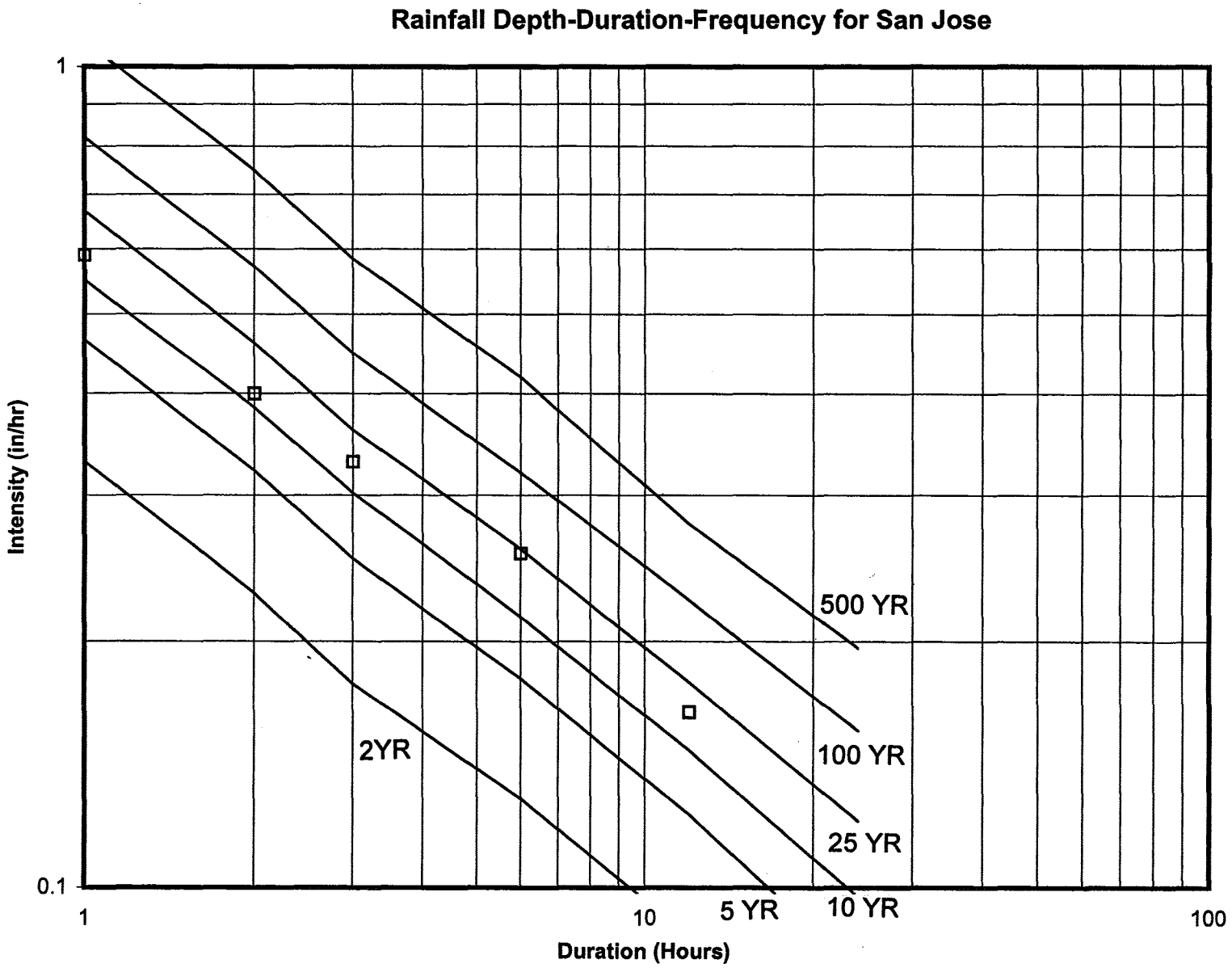

Rainfall Depth-Duration-Frequency for San Jose
Intensity (in/hr)
1
0.1
1
10
100
Duration (Hours)
500 YR
100 YR
25 YR
10 YR
5 YR
2YR

FIGURE 10

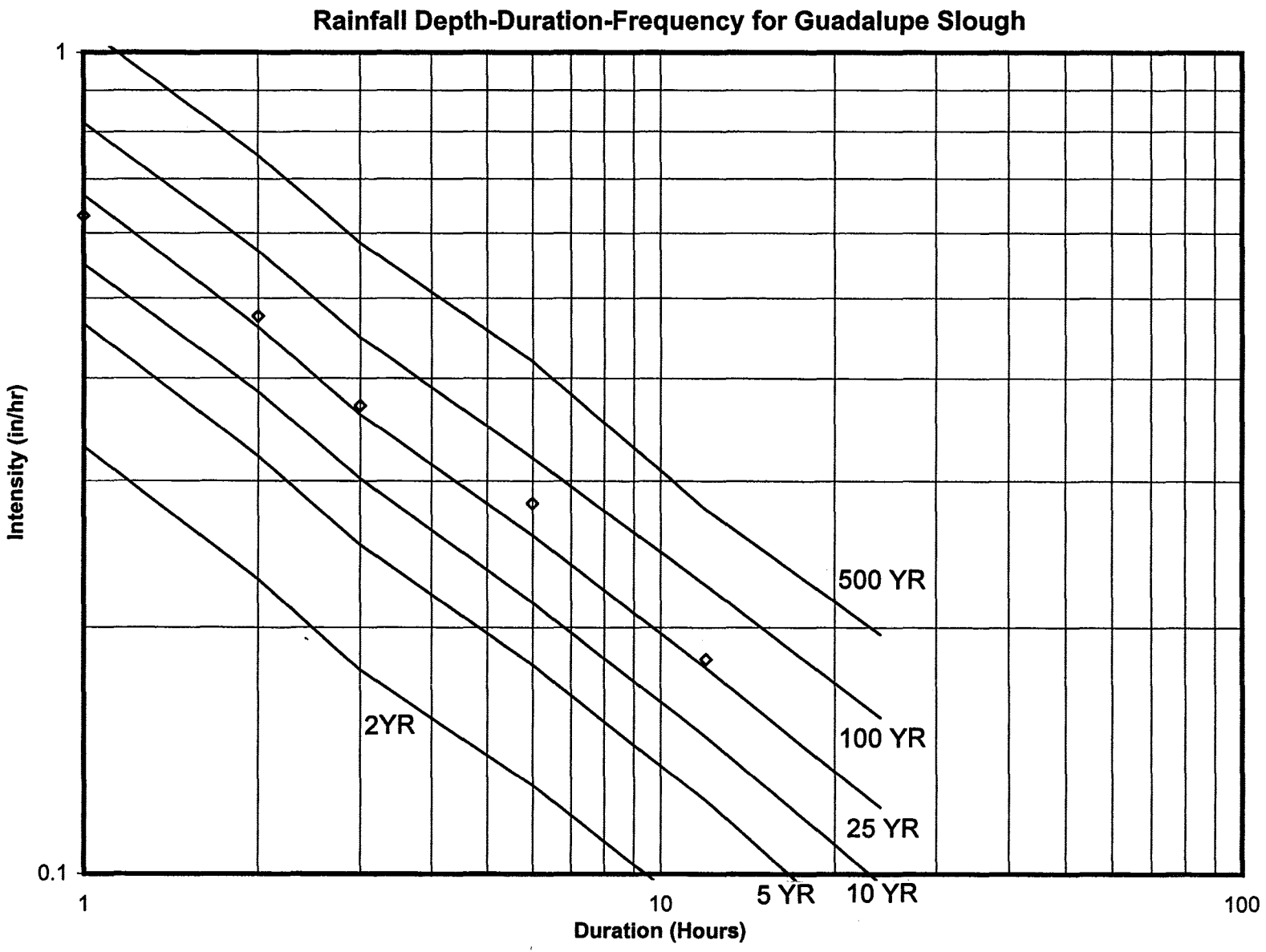

Rainfall Depth-Duration-Frequency for Guadalupe Slough
Intensity (in/hr)
1
0.1
1
10
100
Duration (Hours)
500 YR
100 YR
25 YR
10 YR
5 YR
2YR

FIGURE 11

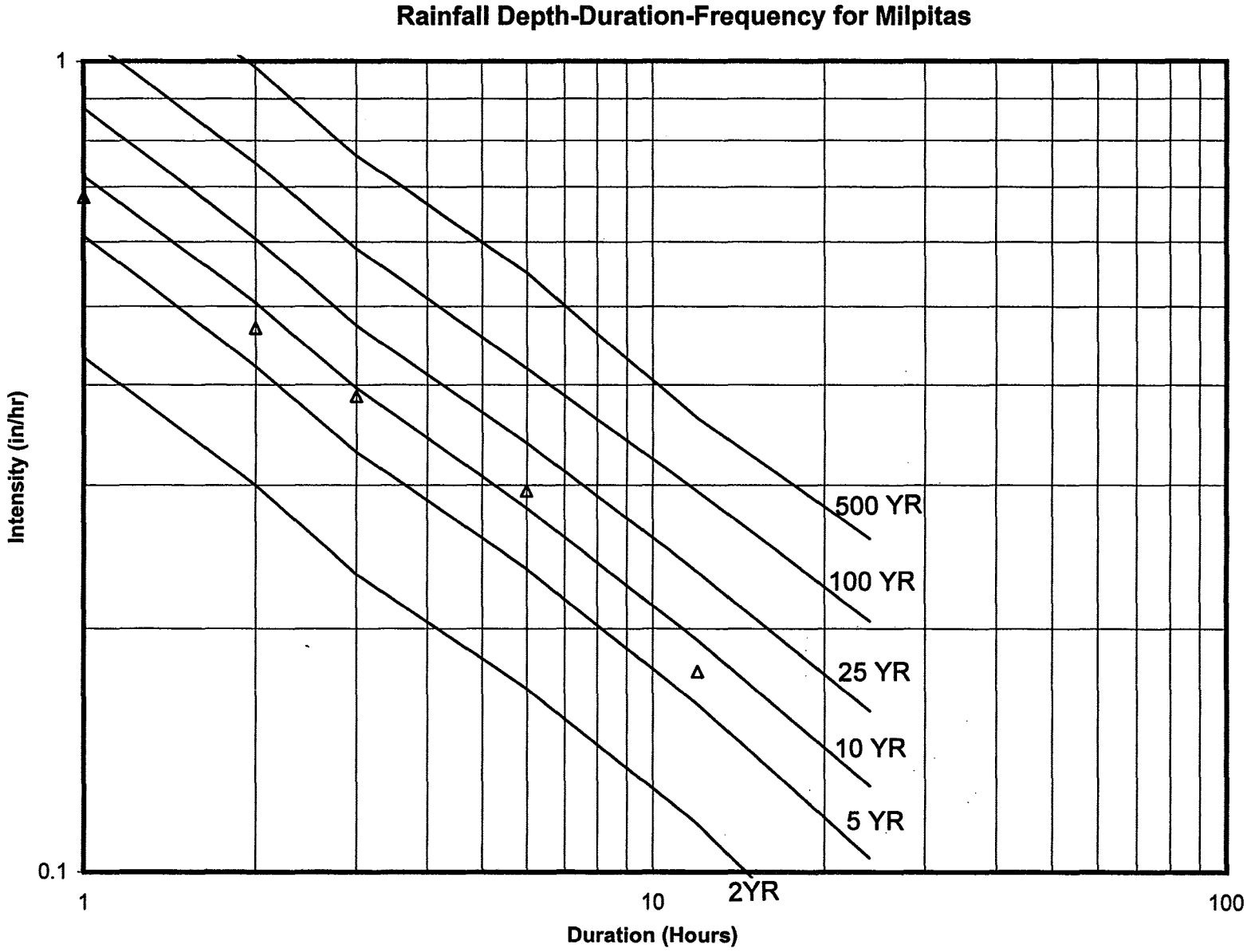

Rainfall Depth-Duration-Frequency for Milpitas
1
0.1
Intensity (in/hr)
500 YR
100 YR
25 YR
10 YR
5 YR
2YR
1
10
100
Duration (Hours)

FIGURE 12

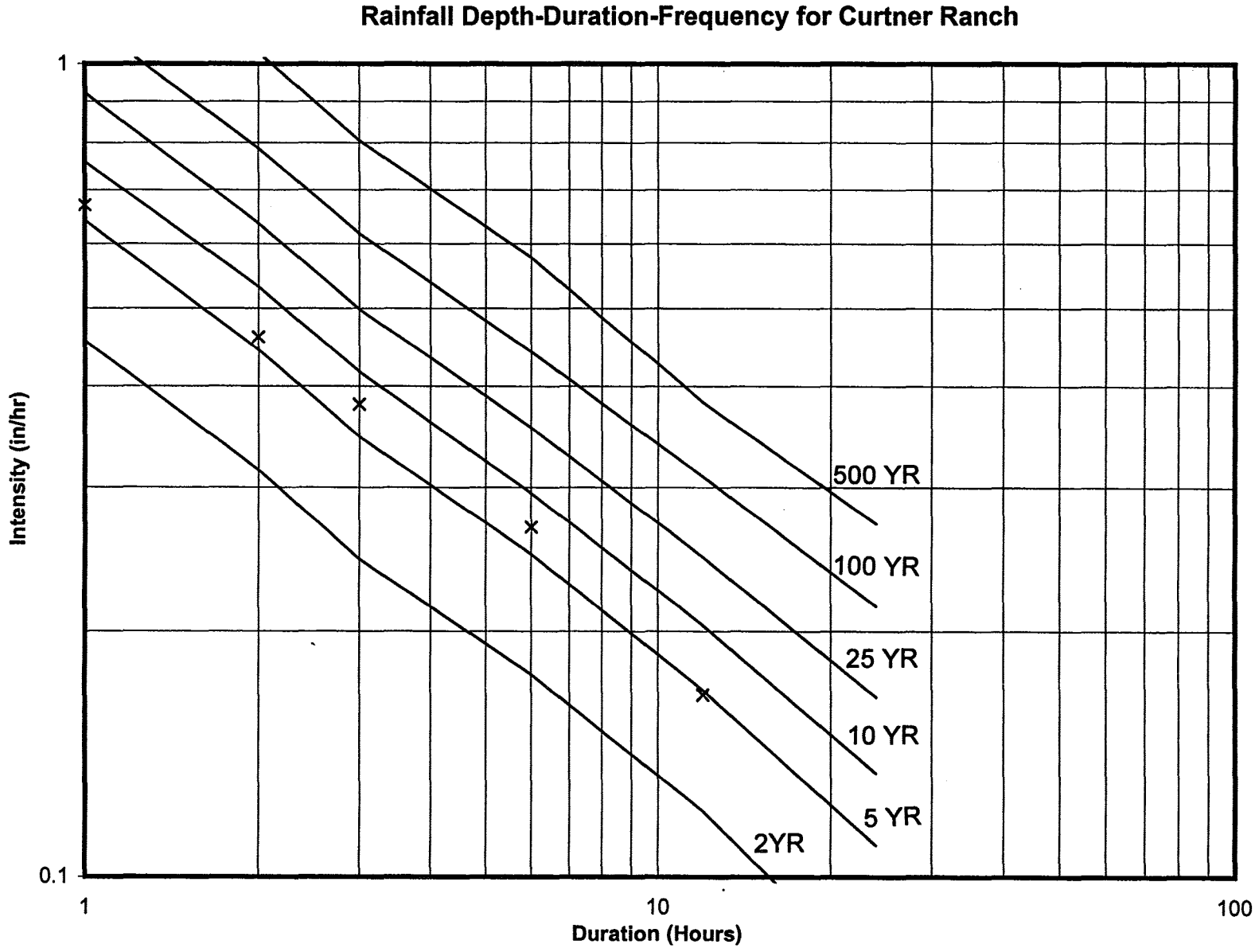

Rainfall Depth-Duration-Frequency for Curtner Ranch
Intensity (in/hr)
1
0.1
1
10
100
Duration (Hours)
500 YR
100 YR
25 YR
10 YR
5 YR
2YR

FIGURE 13

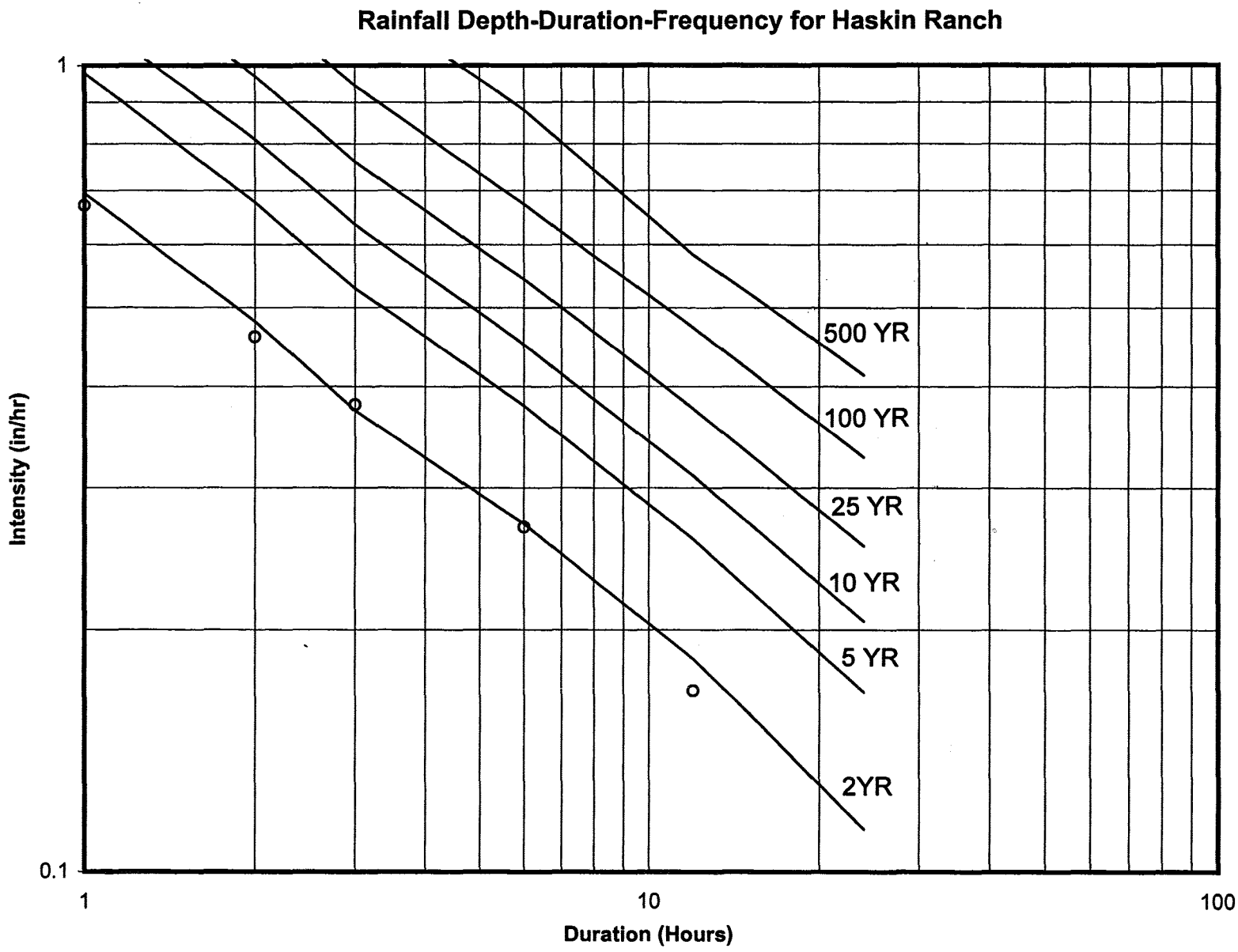

Rainfall Depth-Duration-Frequency for Haskin Ranch
1
0.1
Intensity (in/hr)
1
10
100
Duration (Hours)
500 YR
100 YR
25 YR
10 YR
5 YR
2YR

FIGURE 14

time series of flow rates during the storm event. The hydrographs were used to estimate the stream flows in the channels, the volume of overflows from the channels, and the volume and timing of runoff from local areas within the watershed.

The February 3, 1998 storm was modeled using the Corps of Engineers HEC-1 rainfall-runoff model. The model was used to reconstitute the storm to estimate the Berryessa Creek and Lower Penitencia Creek hydrographs during the storm.

The reconstitution HEC-1 model used a time interval of 15 minutes for calculation, which was considered sufficient for large watersheds such as Berryessa Creek and Lower Penitencia Creek. A shorter time interval would be required to estimate peak flow rates for smaller subareas with short times of concentration.

The storm rainfall pattern for the Curtner Ranch precipitation gauge for the 24-hour period from 12:00 pm February 2 to 12:00 pm February 3 was used for the reconstitution. The Curtner Ranch gauge was the only gauge within the watershed with detailed rainfall records. The Milpitas gauge records include only hourly rainfall amounts. The Curtner Ranch rainfall pattern was considered the most representative of the watershed conditions.

The HEC-1 model was based on a Clark's unit hydrograph. The time of concentration for individual sub-basins within the watershed were estimated based on the Kerby-Hathaway equation. The unit hydrograph assumed a storage coefficient based on a ratio of $R/(T_c+R)$ of 0.5 for the pervious portion of the sub-basin, and 0.2 for the impervious portion of the sub-basin. Separate runoff hydrographs were calculated for the pervious and impervious portions of each sub-basin and combined for the estimated total runoff hydrograph.

Rainfall losses in the rainfall runoff model were estimated using the SCS Curve Number (CN) methodology. For the CN procedure, impervious areas were assumed to have a CN of 98 (maximum runoff). The existing grass, brush and tree cover areas in natural hillside areas were assumed to have a CN range from 46 to 67 (depending on the soil type in each sub-basin) for Antecedent Moisture Condition II (AMC II). Lawn and landscaped open space areas in developed areas were assumed to have a CN of 74 (AMC II).

The AMC value for the storm reconstitution was estimated to be AMC II½. AMC II½ is half way between AMC II and AMC III. AMC II is considered normal antecedent moisture conditions and AMC III is considered very wet antecedent moisture conditions. Based on records from the Milpitas precipitation gauge there was 6.6 inches of rainfall during January 1998, and 1.05 inches of rainfall during the 5 days previous to February 2, 1998. Based on the CN procedure, AMC III implies more than 2.1 inches of rainfall in the previous 5 days during the growing season. The growing season is the period of the year during which vegetation is growing with would intercept rainfall which would otherwise runoff. For the hillside grass land in the Santa Clara Valley, the growing season is during the winter and spring. In other parts of the country with different climates and vegetation, the growing season may differ.

The sub-basin hydrographs were routed through the actual storm drain systems to the streams. The storage discharge relationships for individual sub-basins were based on estimated values used in the flood insurance study and District design hydrology model.

The estimated peak flow rate for the February 3 storm event for Berryessa Creek downstream of the Calera Creek confluence based on the HEC-1 reconstitution model is 3090 cubic feet per second (cfs). The reconstitution model hydrograph is shown in Figure 15. The estimated peak flow rate for Lower Penitencia Creek downstream of the Berryessa Creek confluence is 3546 cfs.

The HEC-1 reconstitution model was also run using the recorded 24-hour rainfall for the Curtner Ranch precipitation gauge, instead of the Milpitas gauge, to evaluate the sensitivity of the reconstitution model to the assumed 24-hour rainfall. The 24-hour rainfall at the Milpitas gauge was 3.03 inches. The 24-hour rainfall at the Curtner Ranch gauge was 2.89 inches. The estimated peak flow rate for Berryessa Creek would be reduced from 3000 cfs to 2990 cfs.

**Previous Flow Rate Estimates**

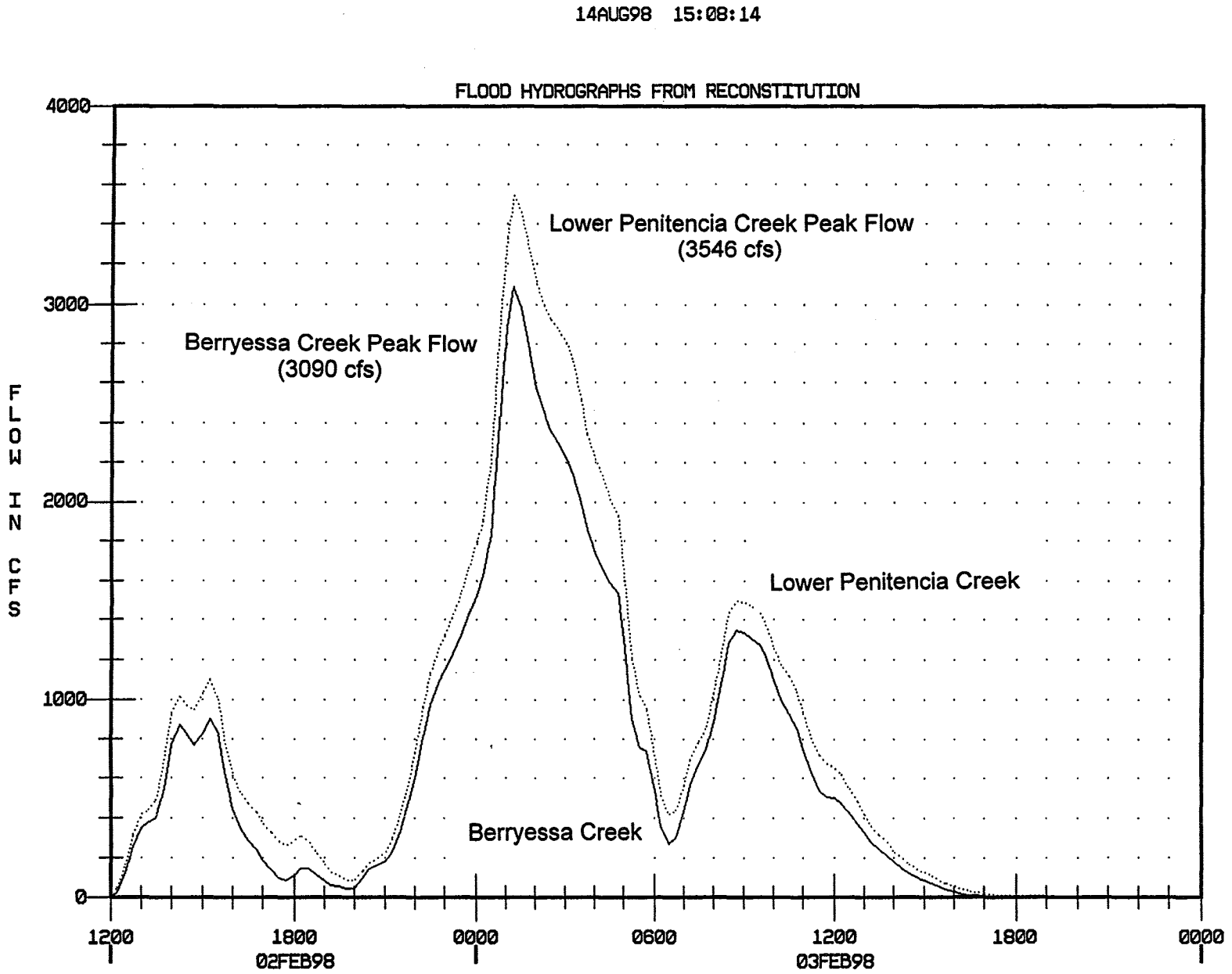
The estimated peak flow rates from the February 3, 1998 storm were compared to previous flow rate estimates for Berryessa Creek and Lower Penitencia Creek used in previous studies. The previous flow rate estimates were used to evaluate whether the February 3, 1998 peak flows exceeded previous estimates or the design flow rates for the stream channels.

Berryessa Creek and Lower Penitencia Creek were studied by detailed methods for the FEMA Flood Insurance Study (FIS) for the City of Milpitas. The estimated peak flow rates from the FIS are listed in table 2.

**Table 2**
**FIS Discharge Estimates**

| Location | Drainage Area (sq. mi.) | 10-Year Peak Discharge (cfs) | 100-Year Peak Discharge (cfs) |
|---|---|---|---|
| **Berryessa Creek** | | | |
| At Confluence with Calera Creek | 21.5 | 1870* | 2730 |
| **Lower Penitencia Ck** | | | |
| At Confluence with Berryessa Creek | 26.7 | 2550* | 3700 |

* Includes low estimate for Berryessa Creek channel capacity at Los Coches Creek




**Berryessa & Lower Penitencia Creeks**
**Flood Hydrogaphs from Reconstitution**
**February 3, 1998 Storm**

FIGURE 15

The District has established flow rates for Berryessa Creek and Lower Penitencia Creek for design purposes. The current design discharges are listed in Table 3.

**Table 3**
**District Design Discharge Estimates**

| Location | Drainage Area (sq. mi.) | 10-Year Peak Discharge (cfs) | 100-Year Peak Discharge (cfs) |
|---|---|---|---|
| **Berryessa Creek** | | | |
| At Confluence with Calera Creek | 21.5 | 3200 | 5600 |
| **Lower Penitencia Ck** | | | |
| At Confluence with Berryessa Creek | 26.7 | 4000 | 7000 |

The differences between the FIS and District design discharge estimates are partially due to the difference in intended purposes for the flow rate estimates. The FIS discharges were estimated for evaluation of the existing flood conditions, and include adjustments in the flow rates for overflows from the stream channels. The District design discharges were estimated for channel design, and assume that the upstream stream channels would have 100-year capacity and no overflows would occur.

The basis for the FIS hydrology was similar to the District design discharges. Based on FIS records, the estimated 100-year discharge for Berryessa Creek downstream of Calera Creek was 5640 cfs before adjustments for upstream overflows. The FIS discharge estimate included adjustments for overflows from Berryessa Creek upstream of Montague Expressway and at Arroyo Los Coches, and overflows from Calera Creek. Based on the hydrology reconstruction model, the estimated February 3, 1998 peak flow of 3090 cfs exceeded the estimated 100-year FIS flow rate of 2730 cfs.

**High Water Marks**

Several high water marks were established after the February 3, 1998 storm. The high water marks were established based on mud or debris lines on fixed objects in the flooded area. The high water marks were surveyed to establish water surface elevations on a common survey datum. The surveyed water surface elevations were used to estimate flow conditions and flood volumes within the flooded area.

The District and City of Milpitas established high water marks after the February 3, 1998 storm near Berryessa Creek at the Calera Creek confluence and at the Jurgens Pump Station in Dixon

Landing Park within the California Landing area. The high water marks near Berryessa Creek were located on the California Landing sound wall on the west side of the SPRR. One highwater mark was located on the southeastern corner of the sound wall, nearest the low point in the Berryessa Creek levee. The second highwater mark was located on the sound wall approximately 700 feet north of the Berryessa Creek levee. The highwater mark at the Jurgens Pump Station was located on the building wall within the pump station.

The established high water marks were located in the field and surveyed to establish the water surface elevations on consistent survey datum. Two survey datums were used to compare the water surface elevations to existing studies and topography. The National Geodetic Vertical Datum of 1929 (NGVD) was the basis for the existing FIS and construction plans for Berryessa Creek, Calera Creek, and Jurgens pump station. The North American Vertical Datum of 1988 (NAVD) was the basis for the existing City of Milpitas topography from 1995. The elevations shown on the flood map topography in Figure 1 are based on NAVD.

**Table 4**
**High Water Mark Elevations**
**February 3, 1998**

| LOCATION | ELEVATION (NGVD) 1929 Datum | ELEVATION (NAVD) 1988 Datum |
|---|---|---|
| Berryessa Creek at Calera Creek | 13.6 | 16.4 |
| SPRR 700' N of Berryessa Ck | 13.0 | 15.8 |
| Jurgens Pump Station | 11.0 | 13.8 |

Based on the field survey, the low point at Berryessa Creek levee at the Calera Creek confluence is at elevation 10.3 feet NGVD (13.1 feet NAVD). Therefore, the maximum water surface elevation was 3.3 feet above the low point at Berryessa Creek. This would allow flood water from Berryessa Creek to overflow from the channel and pond in the area between the California Landing sound wall and the SPRR.

The surveyed elevation for the SPRR top of rail at Berryessa Creek was 13.3 feet NGVD (16.1 feet NAVD). The surveyed elevation for the UPRR top of rail at Berryessa Creek (approximately 20 feet east of the SPRR) was 16.8 feet NGVD (19.6 feet NAVD). Therefore, the high water mark elevation was 0.3 feet over the top of rail at the SPRR, and 3.2 feet below the top of rail for the UPRR.

The surveyed elevation for the floor of the Jurgens pump station was 7.3 feet NGVD (10.1 feet NAVD). Therefore, the high water mark elevation at the pump station was approximately 3.7

feet above the station floor, and approximately 5.7 feet above the low catch basin in Dixon Landing Park.

**Hydraulics Reconstitution**

The peak flow rates from the February 3, 1998 storm reconstitution hydrology were used to reconstitute the channel hydraulics for Lower Penitencia Creek and Berryessa Creek using a step backwater computer model. The reconstitution hydraulics were used to evaluate the potential duration and volume of the overflow from Berryessa Creek at the low point at the Calera Creek confluence. The estimated water surface elevations from the channel hydraulics model were compared to the surveyed highwater mark to evaluate the accuracy of the reconstitution.

The February 3, 1998 storm was modeled using the Corps of Engineers HEC-2 computer model. The model was used to estimate the maximum water surface elevations in Lower Penitencia Creek and Berryessa Creek based on the estimated maximum discharge from the HEC-1 reconstitution. The HEC-2 model was based on channel cross sections from the construction plans for the Lower Penitencia Creek and Berryessa Creek improvements.

The District project included levee improvement for Coyote Creek, and construction of a bypass channel from the San Jose sewage treatment plant to the San Francisco Bay. The project included a weir at the upstream end of the bypass channel to maintain low flows in the historic Coyote Creek channel.

The HEC-2 model starting water surface elevation for Lower Penitencia Creek at Coyote Creek was estimated based on the District flood control project design for lower Coyote Creek. Based on the project design hydraulics, the 10-year water surface elevation at the Lower Penitencia Creek confluence would be 10 feet NGVD (12.8 feet NAVD). The 100-year design water surface elevation would be 11 feet NGVD (13.8 feet NAVD). The 10-year design water surface of 10 feet NGVD (12.8 feet NAVD) was assumed for the February 3, 1998 reconstitution hydraulics. No high water marks or recorded flood elevations have been located for lower Coyote Creek or Lower Penitencia Creek for the February 3, 1998 flood event.

The 10-year design water surface elevation of 10 feet NGVD (12.8 feet NAVD) was based on a tidal elevation of mean higher high water (average highest daily tide) in San Francisco Bay. This was considered reasonable for the February 3, 1998 event, base on tide tables for the bay.

Using the peak flow rate estimates from the hydrology reconstitution, the estimated maximum water surface elevation for Berryessa Creek at the Calera Creek confluence was 12.0 feet NGVD (14.8 feet NAVD). The model assumed a channel flow rate of 3530 cfs for Lower Penitencia Creek and 3090 cfs for Berryessa Creek downstream of the Calera Creek confluence.

The high water mark elevation for Berryessa Creek at the Calera Creek confluence was 13.6 feet NGVD (16.4 feet NAVD). This was 1.6 feet higher than the estimated water surface elevation from the hydraulics reconstitution model and 0.8 feet higher than the 100-year FIS water surface

elevation. The 100-year FIS water surface elevation of 12.8 feet NGVD is 2.5 feet higher than the elevation of the low point at the Calera Creek confluence.

There are several assumptions in the hydraulic model which may affect the estimated water surface elevation. These include the channel flow rates, the starting water surface elevation at Coyote Creek, the channel roughness coefficients, and the channel cross sections. The HEC-2 model was used to evaluate the sensitivity of the estimated water surface elevation for various model parameters.

For the channel flow rates, an increase of approximately 500 cfs in the flow rates would increase the estimated water surface elevation for Berryessa Creek at the Calera Creek confluence by approximately 0.5 feet. Because of the existing upstream capacity restrictions in the Berryessa Creek watershed channels and storm drains, it does not appear likely that the February 3, 1998 event would be significantly larger than the reconstitution estimate.

For the starting water surface elevation, an increase of 1.0 feet in the starting water surface elevation at Coyote Creek would increase the estimated water surface elevation for Berryessa Creek at the Calera Creek confluence by approximately 0.5 feet. An increase of 1.0 feet would increase the assumed Coyote Creek water surface to the 100-year design level of 11 feet NGVD.

For the channel roughness coefficient, the existing HEC-2 model incudes a channel roughness of 0.013 for concrete lined cross sections, and 0.035 for unlined cross sections. Increasing the estimated roughness coefficient by 20 percent would increase the estimated water surface elevation by approximately 0.5 feet. The assumed roughness value was generally for a grass lined channel with a smooth stony channel bottom. Increasing the roughness value to 0.040 would generally be appropriate for a weedy natural stream, or an engineered channel with a rough rocky bottom.

For the channel cross sections, the existing channel cross sections were based on the channel construction plans. Some scour and deposition may have occurred since the channel was constructed. Based on observations of the stream, the channel reach appears to be a deposition area with wetland vegetation in the bottom of the channel which traps sediment. An increase of 1.0 feet in the channel invert from Highway 880 upstream would increase the estimated water surface elevation at the Calera Creek confluence by approximately 0.25 feet. The potential for sedimentation in the channel affecting the estimated water surface appears likely. However, it would require a detailed field survey of the entire channel reach to accurately establish the existing channel invert elevations. A detailed channel survey was beyond the scope of this study.

The District is responsible for maintenance of the Coyote Creek, Lower Penitencia Creek, and Berryessa Creek channels. District maintenance activities within the channels are regulated by the Corps of Engineers, California Department of Fish & Game, and the Regional Water Quality Control Board. The District completed maintenance on half (one side) of Lower Penitencia Creek in 1997. The resources agencies permits allow only half the channel to be maintained in a construction season.

Finally, the observed high water mark may not accurately reflect the typical channel water surface elevation at the overflow location at the Calera Creek confluence. The confluence is on an almost 90 degree bend in the Berryessa Creek channel. The debris line used for the high water mark may have been affected by turbulence and dynamic forces in the transition at the confluence and channel bend. The average velocity head in the Berryessa Creek channel is approximately 0.25 feet.

**Overflow Conditions**

The potential overflow conditions at the low point at the Berryessa Creek levee were evaluated to estimate the peak flow and volume associated with the overflow from the February 3, 1998 storm. Estimates for the peak flow and volume of the channel overflow were necessary to evaluate the effect of the overflow on the operation of the Jurgens Pump Station, and the contribution to the flooding in the California Landing area.

The potential overflow from Berryessa Creek at the Calera Creek confluence is located on the west side of the SPRR. There was a low point between the end of the Berryessa Creek levee and the SPRR embankment fill. The low point is at elevation 10.3 feet NGVD (13.1 feet NAVD). The bottom of the low area is approximately 8 to 10 feet wide. A cross section through the low point area is shown in Figure 16. The low point area is shown in Figure 17.

The low point cross section, shown in Figure 16, extends from the existing Berryessa Creek levee to the SPRR. The cross section also includes the profile elevation information from the 1976 Berryessa Creek construction plans. Construction plans normally show the project as designed. 'As-built' construction plans are updated after construction to include any modifications to the design based on field conditions. The Berryessa Creek levee plans were signed 'as-built'. The as-built construction plans show the levee as extending into the railroad right of way to the railroad fill. The levee plan detail at the railroad is shown in Figure 18. A simplified schematic from the construction plan detail is shown if Figure 19.

The as-built construction plans for the 1978 Calera Creek improvements at the SPRR crossing also show the Berryessa Creek levee extending into the SPRR right of way to above elevation 12 feet NGVD, approximately the elevation of the railroad fill below the gravel ballast. The Calera Creek plan is shown in Figure 20 and 21.

The topography from the 1988 California Landing grading plans includes the low point in the levee at the Calera Creek confluence. The grading plan for the low point area is shown in Figure 22. The low point at the Berryessa Creek levee was at elevation 10.2 feet NGVD. The levee was either not constructed originally as shown on the as-built construction plans, or the levee fill at the low point may have been removed before 1988. A photograph of the Berryessa Creek levee in 1976 from District files show fill near the SPRR. However, the angle of the photograph makes is difficult to determine whether the levee fill extends to the railroad fill.

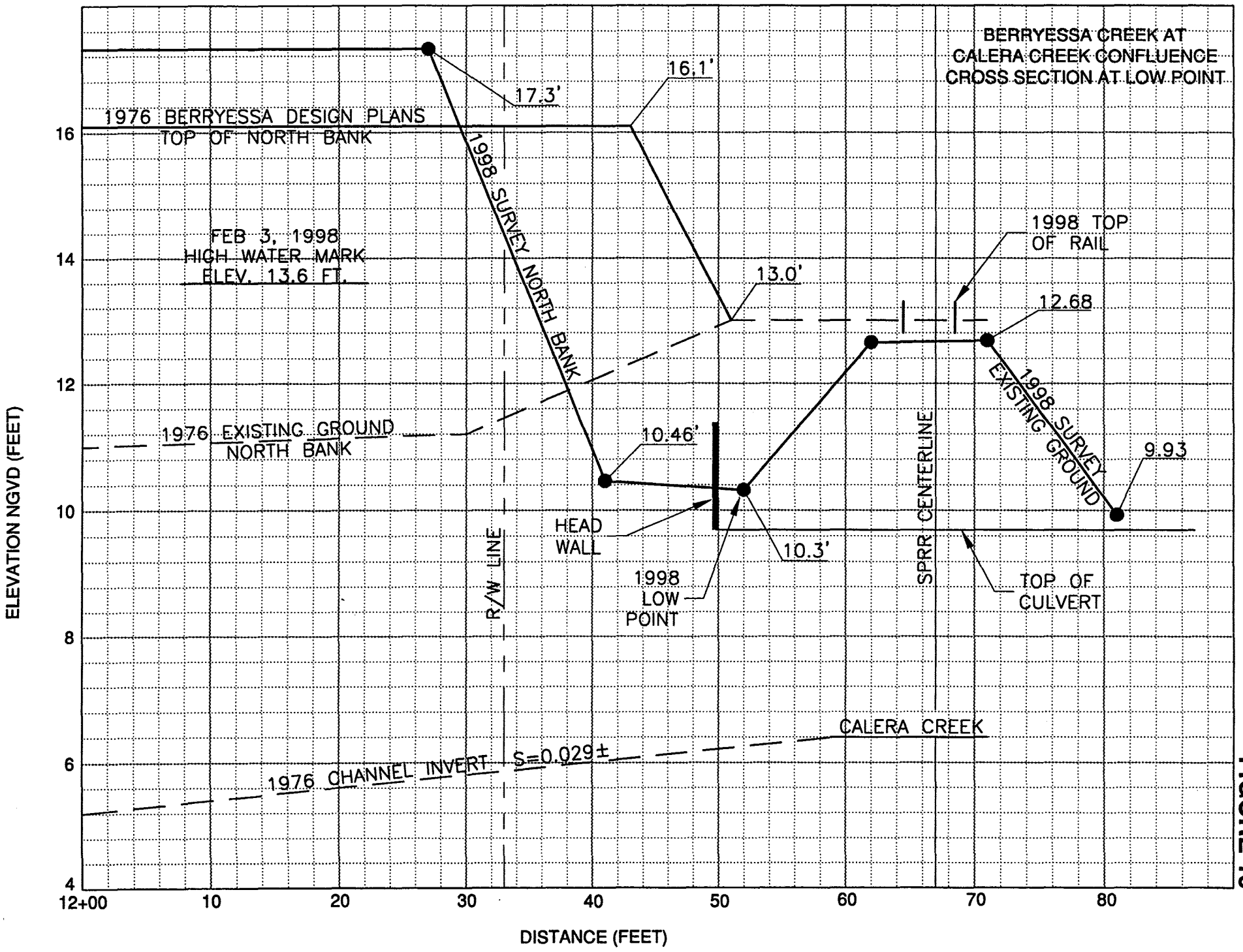
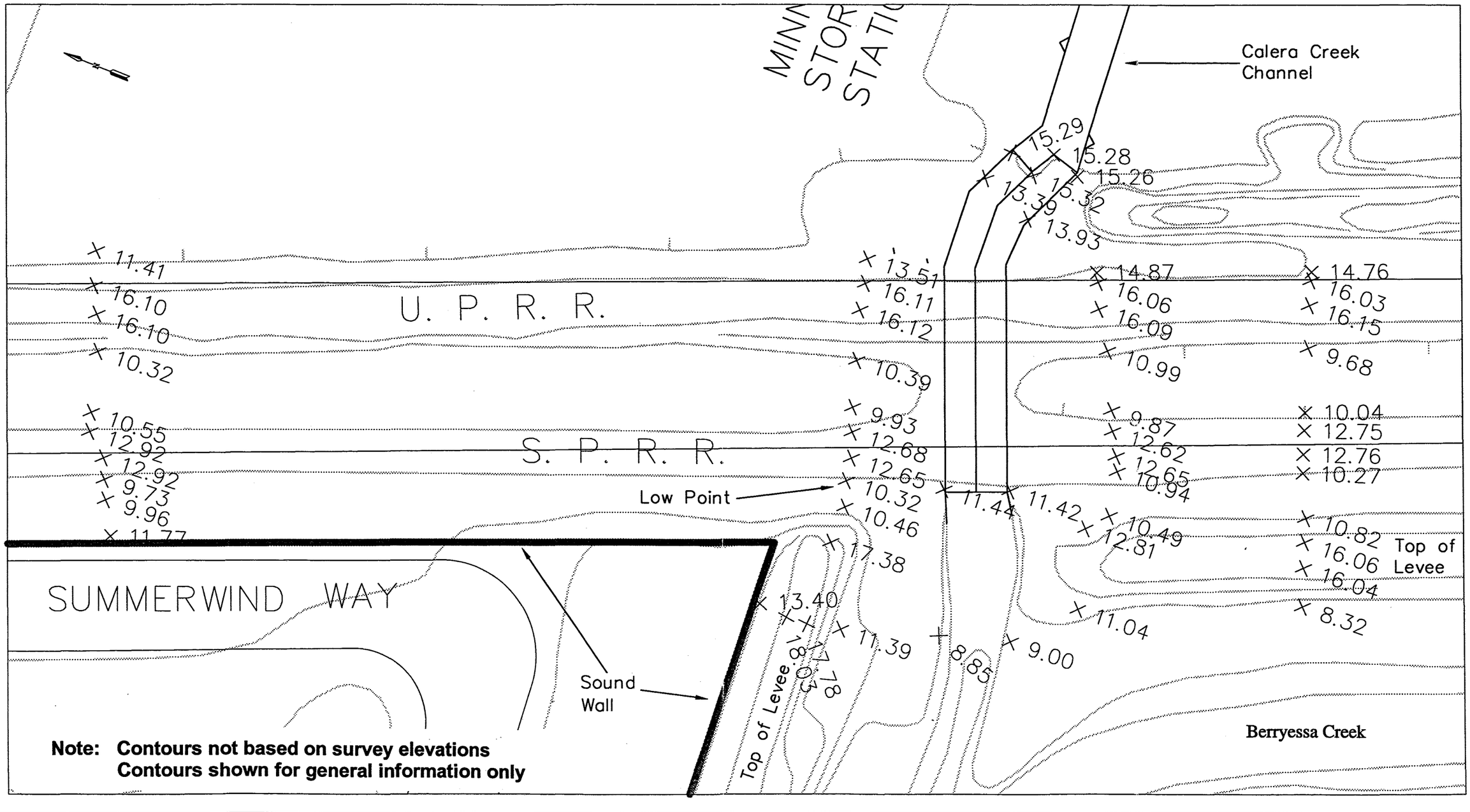

BERRYESSA CREEK AT
CALERA CREEK CONFLUENCE
CROSS SECTION AT LOW POINT
1976 BERRYESSA DESIGN PLANS
TOP OF NORTH BANK
17.3'
16.1'
1998 SURVEY NORTH BANK
FEB 3, 1998
HIGH WATER MARK
ELEV. 13.6 FT.
13.0'
1998 TOP
OF RAIL
12.68
1976 EXISTING GROUND
NORTH BANK
10.46'
1998 SURVEY
EXISTING GROUND
9.93
HEAD
WALL
10.3'
R/W LINE
SPRR CENTERLINE
1998
LOW
POINT
TOP OF
CULVERT
CALERA CREEK
1976 CHANNEL INVERT S=0.029±
ELEVATION NGVD (FEET)
DISTANCE (FEET)
16
14
12
10
8
6
4
12+00
10
20
30
40
50
60
70
80

FIGURE 16

# 1998 Survey Elevations
# Berryessa Creek at Calera Creek

1"=40'

DATUM: NGVD




**Note: Contours not based on survey elevations**
**Contours shown for general information only**

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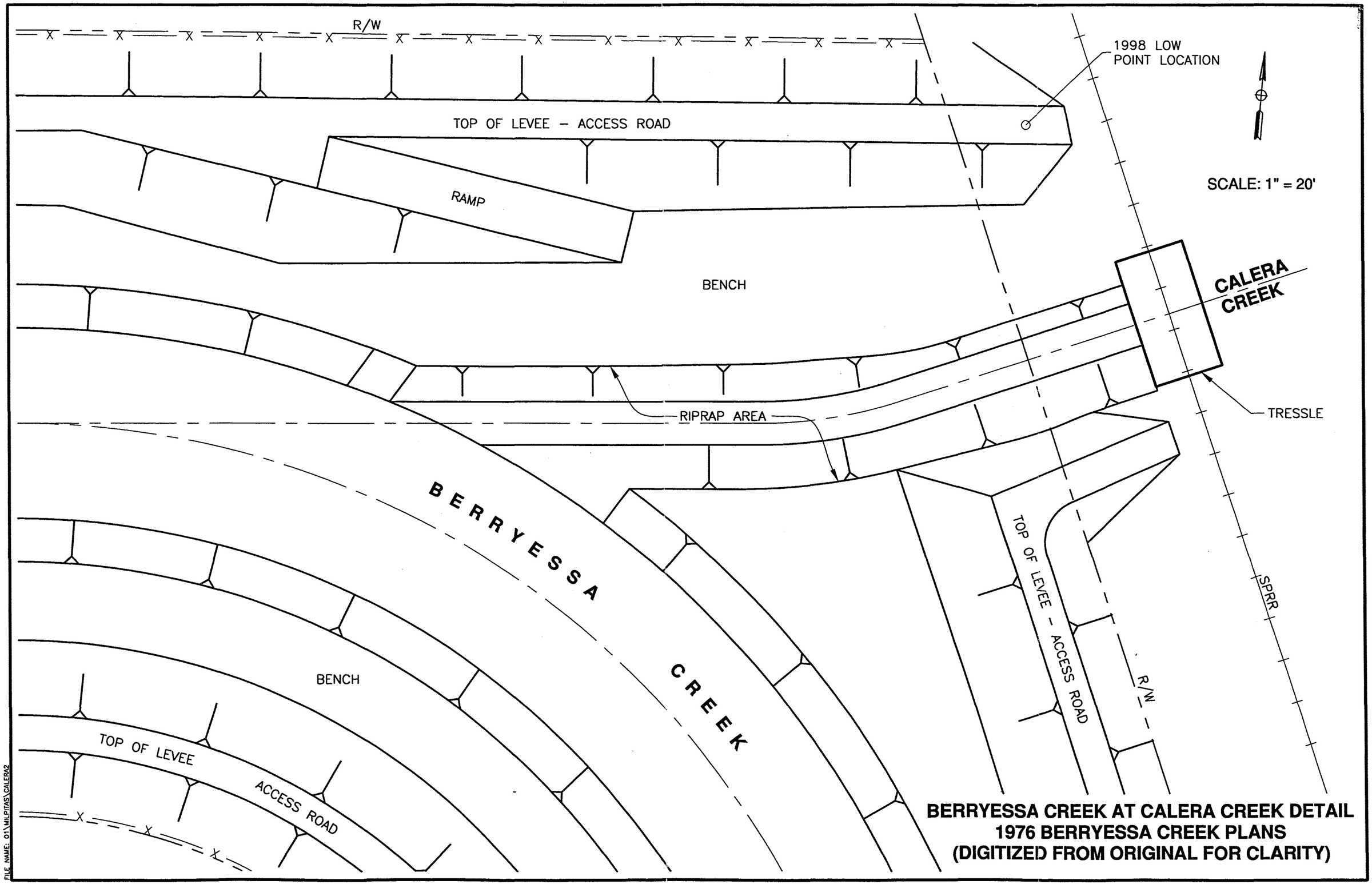
Schaaf & Wheeler

FIGURE 18

Sta. 10+15 "C"-B
Widening Lev
Sta. 10+70 "C" - Be
Sta. 10+95± Begin
See A/14
Sta. 11+4
Construct 6' Chain Link Fence, See 4/12
R/W Line
8' Road
21'
RAMP
12'
Toe Of Levee
Bench Area
10'
B.C. Sta. 11+70 "C"
E.C. Sta. 12+05.32 "C"
Sta. 12+43± "C" P.T. ET O
Begin Conform to Exis
Sta. 12+58 "C" - End "
END CONSTRUCTI
Edge of Existing W
R.R. Trestle
℄ CALERA CREEK
Existing Wood Railroad Trestle
Construct Barricade @ R/W Line See 3/14
N86°51'26"E "C" Line
1A
N68°37'06"E
12
℄ CALERA CREEK
Sacked Concrete Slope Protection
Install Cut-Off Wall & Toe Trench
AB
Bench
℄ Southern Pacific Railroad
Local Drainage
Do Not Disturb
℄ Existing
℄ BERRYESSA CREEK
8' Roadway
11'±
44'

**Berryessa Creek at Calera Creek Detail**
**Berryessa Creek Improvement Plans**
**District Project #4017**
**March 1976**

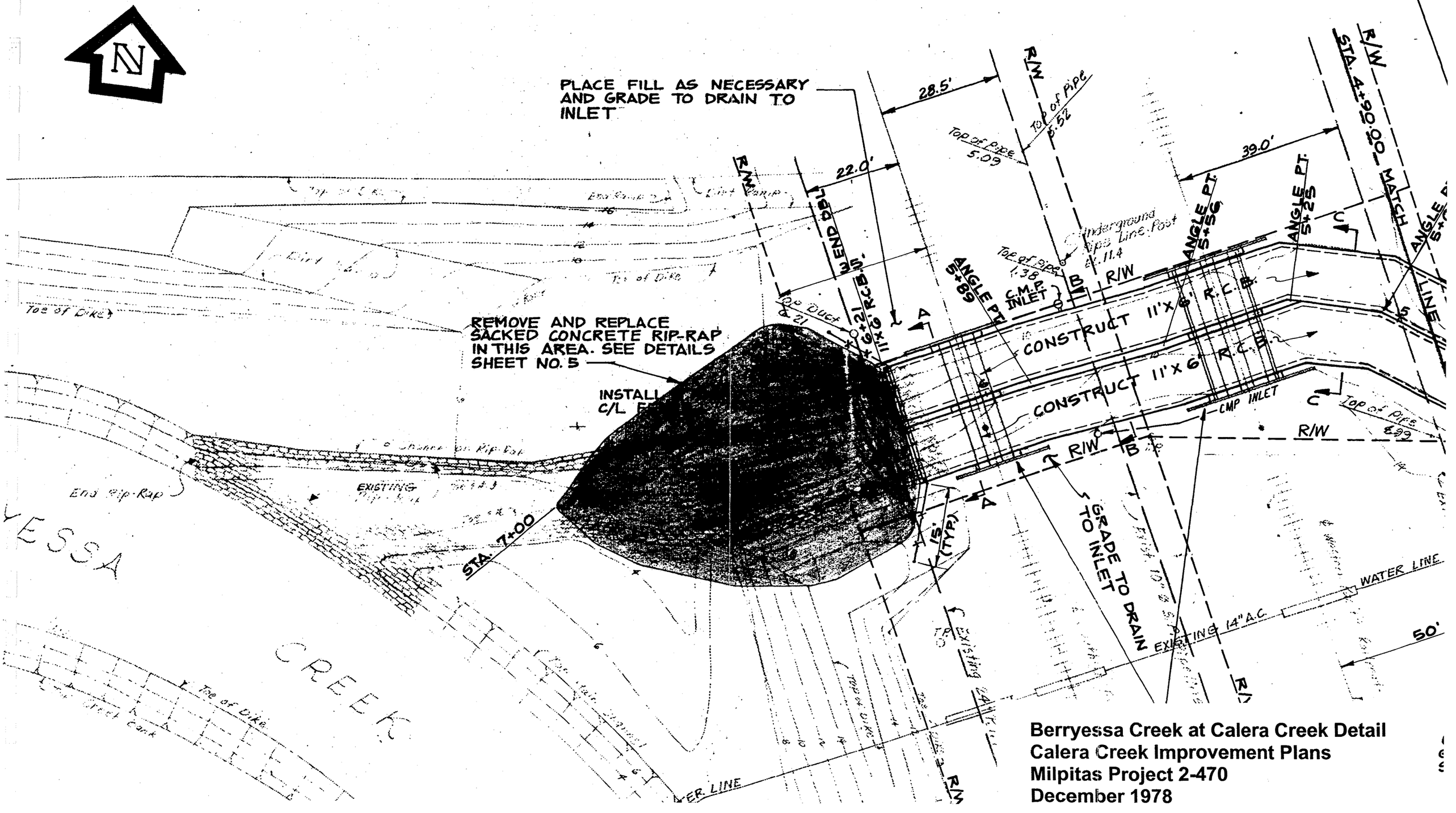
FIGURE 19



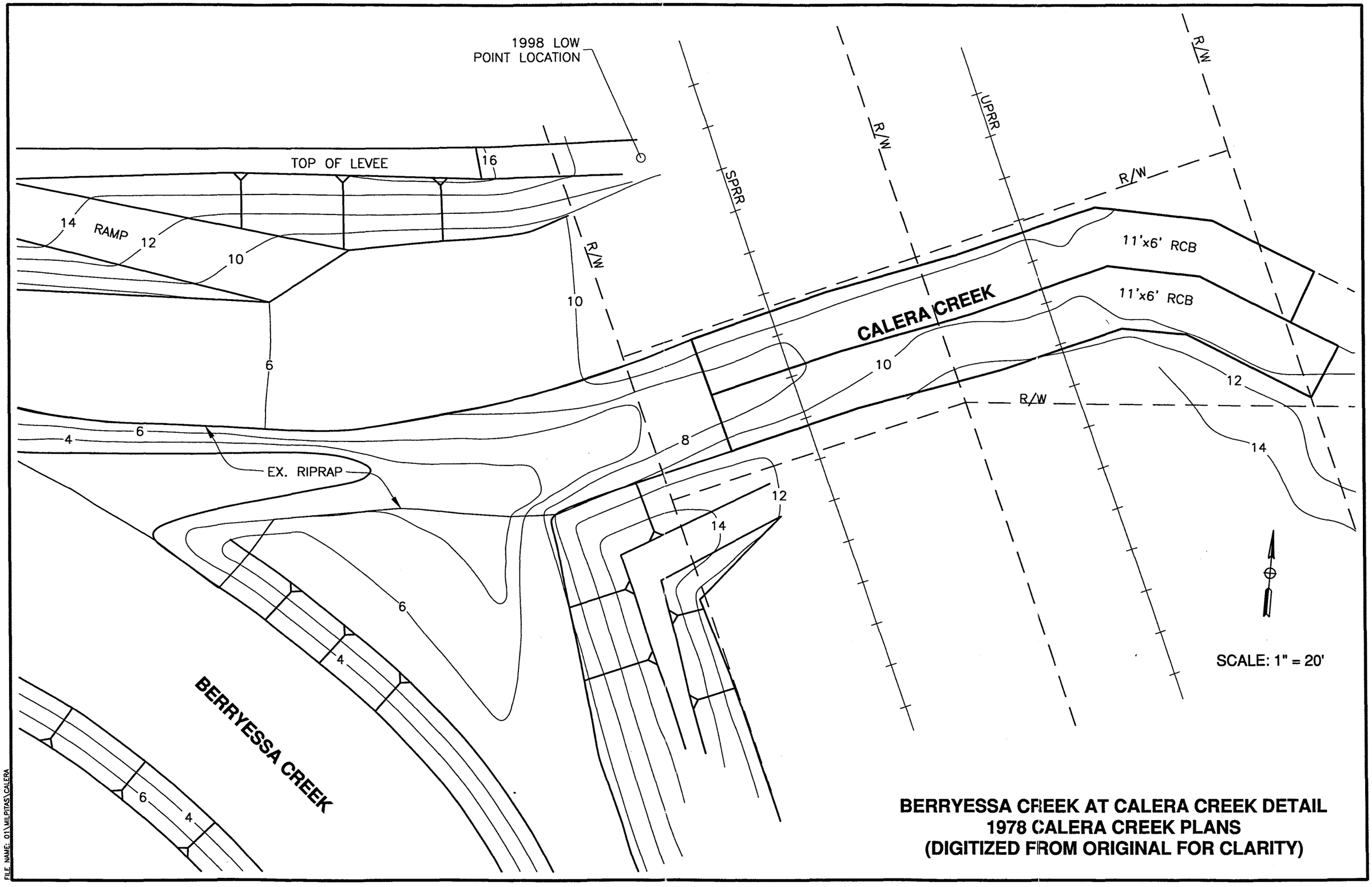

**BERRYESSA CREEK AT CALERA CREEK DETAIL**
**1976 BERRYESSA CREEK PLANS**
**(DIGITIZED FROM ORIGINAL FOR CLARITY)**

Schaaf & Wheeler

FIGURE 20



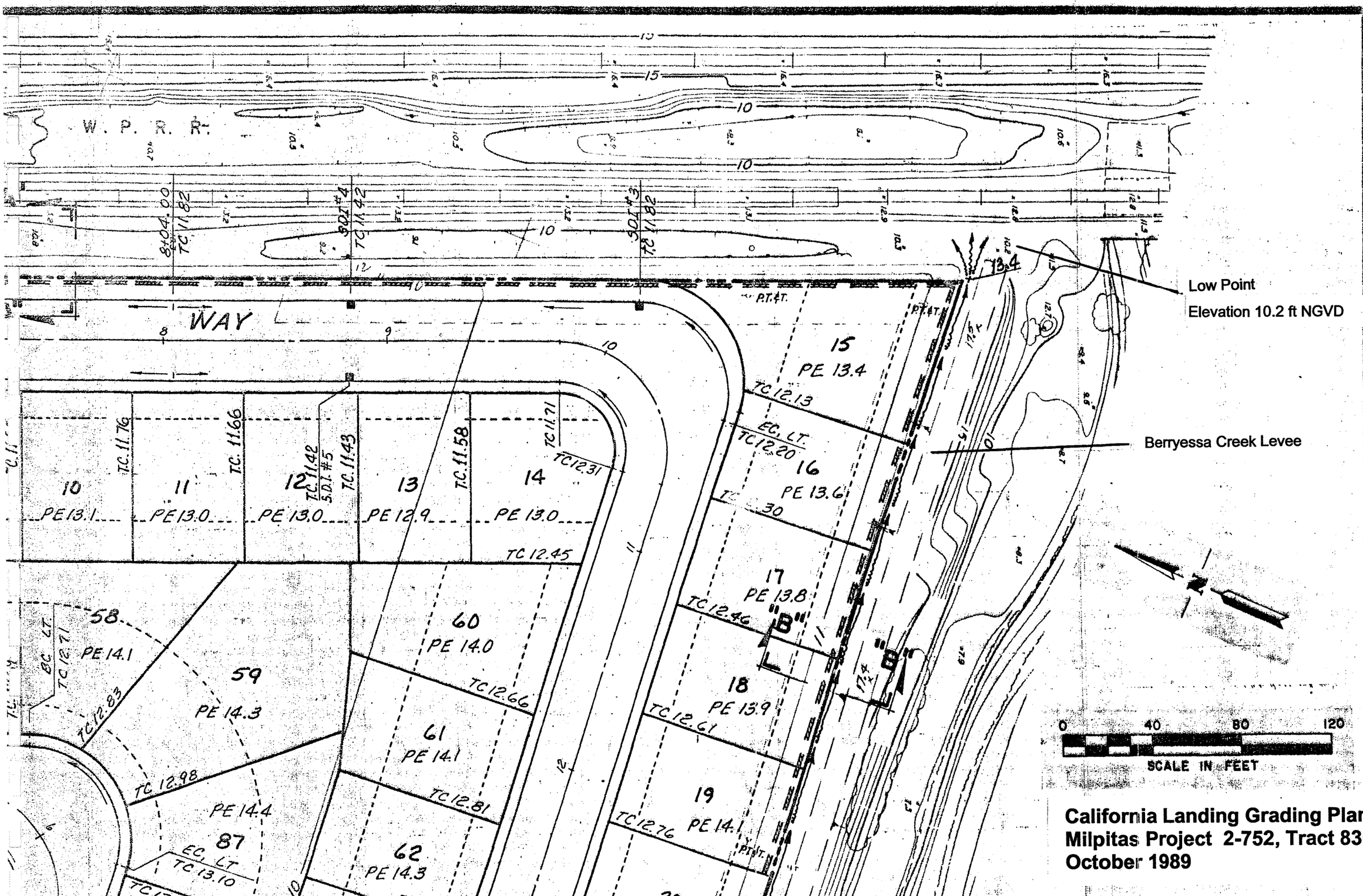

**Berryessa Creek at Calera Creek Detail**
**Calera Creek Improvement Plans**
**Milpitas Project 2-470**
**December 1978**




**BERRYESSA CREEK AT CALERA CREEK DETAIL**
**1978 CALERA CREEK PLANS**
**(DIGITIZED FROM ORIGINAL FOR CLARITY)**

FILE NAME: 01\MILPITAS\CALERA

FIGURE 22




BISSELL & KARN, INC.
CIVIL ENGINEERS
100 N. MILPITAS BLVD., MILPITAS, CALIF. 95035
(408) 263-7615

**California Landing Grading Plans**
**Milpitas Project 2-752, Tract 8303**
**October 1989**

**Table 5**
**Important Elevations**
**Berryessa Creek at Calera Creek**

| LOCATION | ELEVATION (NGVD) 1929 Datum | ELEVATION (NAVD) 1988 Datum |
|---|---|---|
| **High Water Mark 2/3/98 At overflow** | **13.6** | **16.4** |
| **High Water Mark 2/3/98 700' N of Berryessa Ck** | **13.0** | **15.8** |
| | | |
| Top of Berryessa Ck Levee | 17.2 ft | 20.0 ft |
| District 1992 100-Yr WSEL | 14.2 | 17.0 |
| District 1992 10-Yr WSEL | 13.0 | 15.8 |
| FIS 100-Yr WSEL | 12.8 | 15.6 |
| FIS 10-Yr WSEL | 11.5 | 14.3 |
| Reconstitution WSEL | 12.0 | 14.8 |
| Low Grade at Levee | 10.3 | 13.1 |
| SPRR Top of Rail | 13.3 | 16.1 |
| SPRR Grade | 12.7 | 15.5 |
| UPRR Top of Rail | 16.8 | 19.6 |
| UPRR Grade | 16.3 | 19.1 |
| U/S Calera Ck Headwall | 15.3 | 18.1 |
| D/S Calera Ck Headwall | 11.4 | 14.2 |
| U/S Calera Ck Culvert Invert | 6.3 | 9.1 |
| D/S Calera Ck Culvert Invert | 3.7 | 6.5 |
| | | |

The low area west of the railroad extends north along the SPRR, between the California Landing area sound wall and the railroad fill. There were no designed openings in the sound wall which would allow flood flows into the California Landing area. However, the sound wall was not designed to contain flood water. The sound wall is constructed with concrete posts on 5-foot

centers, with concrete panels between the posts. The panels extend down to approximately the curb elevation on Summerwind Way on the west side of the wall. Fill for landscaping along the wall was the only protection from flow under the sound wall. The sound wall was undermined in numerous locations along the SPRR right of way. Field observations for the southern 700 feet of the sound wall identified over 25 locations where the earth under the wall had been washed away. More openings may exist in areas which were not observed. The openings under the wall varied in size from 2 or 3 inches high and 1 foot wide up to over 1 foot high and 4 feet wide. In general, the openings occurred in areas where the sound wall is closest to the road and had the least fill over the bottom of the wall.

The potential flow under the sound wall in the area between the high water marks was estimated based on orifice flow through the observed openings and the high water mark elevations along the wall. The maximum estimated flow rate for the observed openings was 275 cfs. This assumes a free outflow for each orifice and no backwater due to flow along Summerwind Way. The high water elevations on the upstream side of the wall are over 1.0 feet above the highest elevation on Summerwind Way, and 2.7 feet above the road at the lowest elevation on Summerwind Way. For an average hydraulic head on each orifice of 1.0 feet, the estimated total orifice flow would be 210 cfs. For an average hydraulic head on each orifice of 0.5 feet, the estimated total orifice flow would be 150 cfs.

The high water marks along the SPRR right of way show a slope from the low point at the Berryessa Creek levee location north along the sound wall. The high water mark approximately 700 feet north of Berryessa Creek is 0.6 feet lower than the high water mark at the creek levee. This is consistent with the overflow from the channel flowing north along the area between the sound wall and the railroad. The maximum flow rate for the overflow was estimated using the Corps of Engineers step backwater computer program. Based on the surveyed cross sections for the area and the high water mark slope, the peak flow rate was estimated to be approximately 350 cfs. This is consistent with the approximate overflow flow rate estimated from the orifice calculations.

The flow cross section along the SPRR were assumed to be restricted to the area between the sound wall and the SPRR, and did not include the low area between the SPRR and the UPRR. For most of the length between the two high water marks, the top of rail elevations are above the high water mark elevations. Flow between the railroads would have to flow through the gravel railroad ballast and under the rails to reach the sound wall. The potential flow was not considered sufficient to adjust the estimated peak overflow flow rate for the flow between the sound wall and the railroad.

The overflow flow rate estimate of 350 cfs, based on the flow along the SPRR, was used to estimate the overflow volume and contribution to the California Landing area. The estimate based on orifice flow under the sound wall was lower, but considered only orifice flow in the area between the high water marks. Several large openings under the sound wall near Dixon Landing Park, approximately 1000 feet to the north, were not included. Therefore, the orifice flow estimate would underestimate the potential overflow. The overflow estimate based on the flow along the SPRR would include all of the potential flow, and was considered more accurate.

If the fill shown on the 1976 Berryessa Creek improvement plans had been in place at the time of the February 3, 1998 storm, the level of protection from the creek overflows would have been higher. The flood elevation would have to reach the elevation of the SPRR at 12.7 feet NGVD to overflow, instead of the low point elevation of 10.3 feet NGVD. The potential overflow would have occurred later in the storm, at a higher water surface elevation, and the volume of the overflow would have been smaller. However, the peak flow rate and volume of the overflow would depend on whether the levee fill was scoured by flow around the end of the levee, whether the railroad ballast gravel washed out, and whether the openings under the sound wall wash out in the same manner as the actual event. No estimate of the potential overflow flow rate or volume was prepared.

**Overflow Volume**

The overflow volume from Berryessa Creek during the February 3, 1998 storm was estimated to evaluate the impact of the channel overflow on the ponding in the California Landing area. The total overflow volume was estimated based on the flood hydrograph, and the estimated peak flow rate of the overflow. The hydrograph was used to estimate the duration of the overflow.
The potential overflow volume was estimated from the reconstitution flood hydrograph, shown in Figure 15, assuming that Berryessa Creek has a capacity of 2740 cfs at the low point. The entire volume greater than 2750 cfs was assumed to overflow to the California Landing area. The 2750 cfs capacity was estimated based on the peak flow rate in the channel of 3090 cfs, and the estimated peak overflow flow rate of 350 cfs. The total volume in the reconstitution hydrograph above 2750 cfs is 16 acre feet.

The actual flow rate at which the overflow would start would depend on the ponding needed to wash out the fill under the sound wall. A flow of 2750 cfs in the Berryessa Creek channel would have a channel water surface elevation approximately 0.5 feet lower than the estimated water surface for the estimated maximum flow of 3090 cfs. Therefore, the water surface elevations at the sound wall for a channel flow of 2740 cfs would be approximately 0.5 feet lower than the high water mark elevations. This would be approximately 0.5 feet above the typical elevation of the bottom of the sound wall. This was considered sufficient to begin washing out the fill under the sound wall.

Some additional overflow volume would be expected to occur on the receding leg of the channel hydrograph. However, the overflow flow rate would depend on the flow conditions within the low area along the SPRR and at each opening under the sound wall. The volume of the overflow was not adjusted to account for potential overflows for channel flow rates less than 2750 cfs.

There is a cross culvert under the UPRR which drains the low area between the SPRR and the UPRR. The culvert drains to the east to a swale east of the railroad. The swale drains to the Minnis Pump Station drainage system. The culvert location is shown in Figure 1. The high water mark at the Berryessa Creek levee was above the SPRR fill, but below the elevation of the UPRR fill. The area between the railroads was flooded and flood water would flow through the culvert under the UPRR to the area east of the railroad. The area east of the railroad is approximately 1 foot below the high water mark elevation near the culvert. Part of the City of

Milpitas corporation yard was flooded during the February 3, 1998 storm. The area of flooding is shown in Figure 1. The area is not part of the Jurgens Pump Station system drainage area. Drainage from the area is pumped to Calera Creek by the Minnis Pump Station. The volume of the overflow to the area east of the UPRR was not estimated and was not included in the estimated overflow volume which contributed to the Jurgens Pump Station.

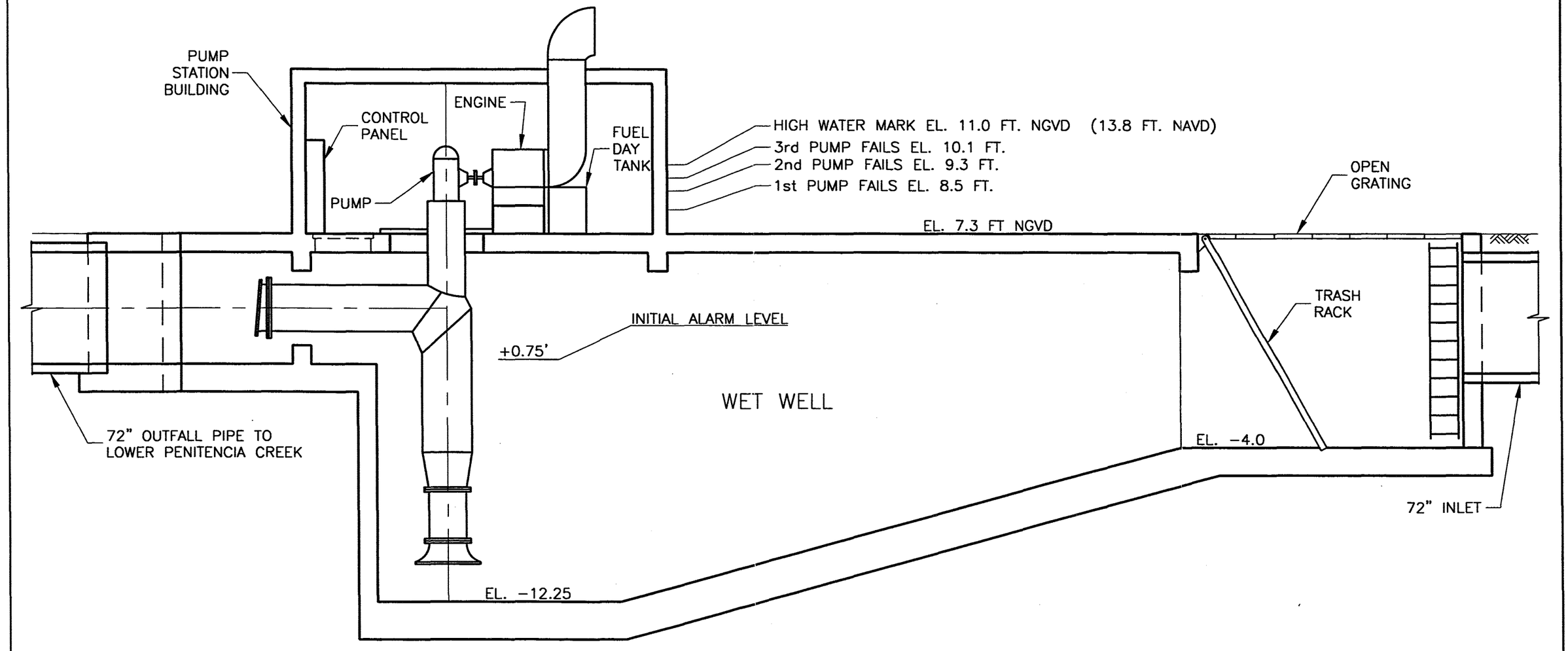
**Jurgens Pump Station**

The Jurgens Pump Station was evaluated based on the estimated flow rates for the drainage system inflows and the overflow from Berryessa Creek. The evaluation was based on the pump station construction plans, observed conditions at the pump station, and City of Milpitas maintenance staff recollections of the events during the February 3, 1998 storm. The hydraulic design calculations for the pump station were not available in the existing records. The pump station evaluation included an estimate of the storage in Dixon Landing Park and the water surface elevation during the flood period at 15 minute intervals. The pump station location is shown in Figures 1 and 2. A cross section through the pump station is shown in Figure 23.

The storage in Dixon Landing Park was estimated for 15 minute time intervals based on the estimated inflows from the storm drainage system and overflows from Berryessa Creek, and the pumping capacity of the individual pumps at the station. The inflow hydrograph for the entire local drainage system, including the area east of the railroad, was based on the reconstitution model. The overflow from Berryessa Creek was based on the overflow hydrograph estimated from the reconstitution model, assuming a maximum overflow of 350 cfs. The storage in Dixon Landing Park was estimated as the difference between the inflow and the outflow. The storage was estimated for the volume in the park above the lowest drainage inlet. The volume in the station wet well was not included. The volume in the wet well would be filled before storage in the park area. The volume in the wet well is normally used to compensate for differences between the inflow and pump outflow as the individual pumps turn on and off. The storage in the park was designed to compensate for differences between the maximum inflow and the maximum pump station capacity with all four pumps operating. The water surface elevation in the park was estimated from the storage based on the topography from the City 1995 maps.

The results of the pump station operation evaluation are shown in Figure 24. The station inflows are shown at 15 minute intervals from 10 pm on February 2 to 10 am on February 3, 1998. For the period until 12:15 am on February 3, the pump station would have capacity for the inflow from the storm drain system. The estimated peak flow from the local drainage area (298 cfs) occurred at 12:45 am, approximately the same time as the overflow from Berryessa Creek was starting. The peak total inflow (530 cfs) was estimated to occur at 1:15 am., after the peak inflow from the local drainage system. The peak total inflow included 350 cfs from the overflow, and 180 cfs from the local drainage system inflow.

The failure of the pump station appears to have been due to flooding of the control system, which is located within a cabinet within the pump station building. The lowest control board for one of the pumps is 15 inches off the floor, at elevation 8.5 feet NGVD. The control boards are mounted vertically. The second pump control board is at elevation 9.3 feet NGVD. The third




# JURGENS PUMP STATION

SCALE: 3/16" = 1'-0"

FILE NAME: 01\MILPITAS\PUMP

Schaaf & Wheeler

# California Landing
# Inflow, Outflow & Storage

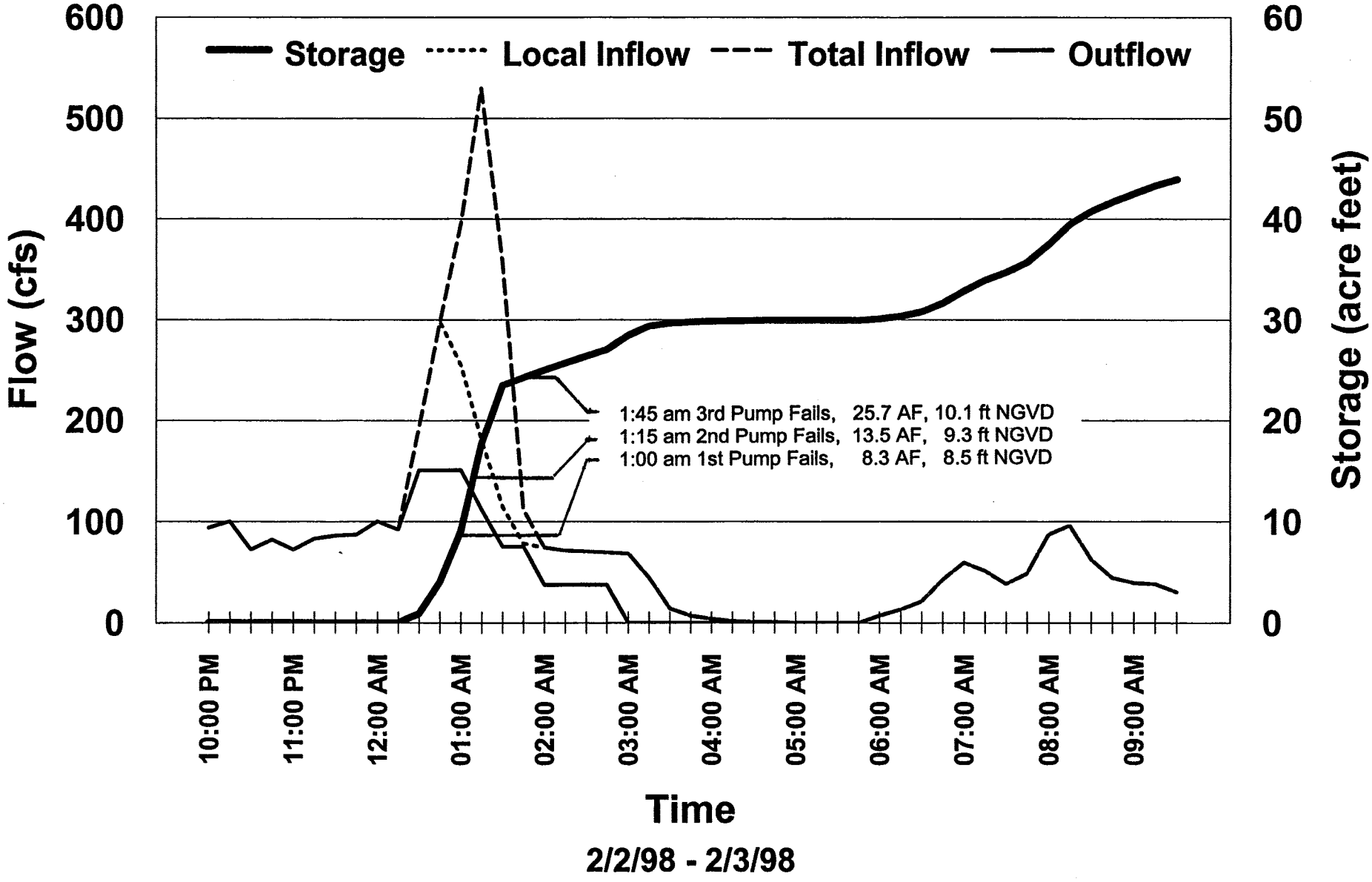



FIGURE 24

pump control board is at elevation 10.1 feet. The fourth pump control board is at elevation 11.1 feet. The batteries for the engines are located on the floor, but the engine alternators would provide power for the control system if the batteries are flooded. The alternators are protected against short circuits in the batteries.

The storage estimates shown in Figure 24 assume that the individual pumps would fail as the corresponding control board is flooded. The first pump would fail at elevation 8.5 feet, at 1:00 am, at a storage volume of 8.3 acre feet. The second pump would fail at elevation 9.3 feet, at 1:15 am, at a storage volume of 13.5 acre feet. The third pump would fail at elevation 10.1 feet, at 1:45 am, at a storage volume of 25.7 acre feet.

**Table 6**
**Important Elevations**
**Jurgens Pump Station**

| LOCATION | ELEVATION (NGVD) 1929 Datum | ELEVATION (NAVD) 1988 Datum |
|---|---|---|
| | | |
| **High water Mark 2/3/98 At Jurgens Pump Station** | **11.0** | **13.8** |
| | | |
| 4th Pump Fails | 11.1 | 13.9 |
| 3rd Pump Fails | 10.1 | 12.9 |
| 2nd Pump Fails | 9.3 | 12.1 |
| 1st Pump Fails | 8.5 | 11.3 |
| Top of Fuel Day Tank | 10.0 | 12.8 |
| | | |
| Floor at Jurgens Pump Station | 7.3 | 10.1 |
| Low Inlet - Dixon Landing Park | 5.2 | 8.0 |
| Initial High Water Level Alarm | 0.8 | 3.6 |
| Bottom of Wet Well | -12.3 | -9.5 |
| | | |

Based on the City of Milpitas dispatch log during the storm, there were two alarms from the Jurgens Pump Station. At 10:21 pm February 2, 1998 there was a high water alarm. The duty

maintenance staff responding to the alarm reset the alarm level to a higher elevation within the wet well. The initial alarm level was at approximately 0.8 feet NGVD, below the level of the detention area in Dixon Landing Park. The alarm level was reset to approximately elevation 2.3 feet NGVD, still below the elevation of the park.

The second alarm at the Jurgens Pump Station occurred at 12:13 am, February 3, 1998. The duty maintenance staff again reset the alarm level higher as the water level in the wet well was rising. All four pumps were operating. The station alarm was reset and triggered six additional times between 12:14 and 12:36 am. The alarm will not trigger unless the alarm board within the station is manually reset at the station. The maintenance staff left to check other stations while the water levels were still rising at the Jurgens Pump Station, near 12:30 am, February 3, 1998.

The timing the beginning of flooding based on the estimated pump station operation is generally consistent with the alarm conditions between 12:15 and 12:30 am. The discrepancy in timing may be due to the 15 minute time increments used in the hydrology reconstitution model and estimated pump station operation. Alternatively, the timing of the rainfall in the rainfall runoff model may not correspond to the actual rainfall in the local drainage area, or the runoff flow within the storm drain system may respond more slowly than the model estimate.

The station was observed again between 2:00 am and 2:30 am. At that time, there was significant flooding in the park and surrounding streets. One pump at the station appeared to be running, but sounded 'labored'. This is consistent with the estimated operations which showed three pumps would have failed, one pump would be running, and the flooding would be 2.8 feet deep within the pump station. With the flooding in the station, the pump would be operating at much less than the design head for the pump. The pump impeller would cavitate due to the small pressure difference across the pump. This would cause significant vibration of the equipment, and the engine would not be operating at full power.

The high water mark within the station was lower than the elevation of the control board for the last pump. No mechanism for the shut down of the last pump has been identified. However, the last pump did stop some time after the 2:30 am observations. The flooding may have reached a secondary component on the master panel for the engine controls which stopped the last pump. All of the equipment boards in the control system were replaced after the flood event. Alternatively, the fuel system may have been affected by the flooding. The fuel is contained in an underground tank outside the station and is pumped to a day tank within the station. The day tank was flooded before the last pump failed. The top of the day tank is at elevation 10.0 feet NGVD. The pump was assumed to stop at 3:00 am in the estimated operation. The last pump had stopped operation before the next observation before dawn.

The estimated pump station operation shows that the water surface elevation would be approximately 10.1 feet (NGVD) at 2:30 am, which is 0.9 feet below the maximum flood elevation from the high water mark at the pump station. However, there was a second period of rain which occurred between 6:00 am and 10:00 am on February 3, 1998. Without the Jurgens Pump Station, the additional runoff would contribute to the ponded flooding in the California Landing area. The estimated operation show that the flooding would reach the high water mark

elevation of 11.0 feet NGVD (13.8 feet NAVD) at approximately 8:30 am. Based on the 1995 topographic maps, the low point between Dixon Landing Park and Dixon Landing Road is at elevation 11.2 feet NGVD (14.0 feet NAVD). Given the potential errors in the topography, it is probable that the maximum flood elevation reached the level required to overflow through the apartment parking and driveway areas to Dixon Landing Road. The maximum level of the ponding in Dixon Landing Park would be controlled by the level of the overflow to Dixon Landing Road.

An alternative operation scenario was estimated assuming that the overflow from Berryessa Creek did not occur. This assumed that the pump station inflow would be only the local drainage system inflow during the February 3, 1998 storm, without the overflow from Berryessa Creek. The estimated operation without the creek overflow is shown in Figure 25. The maximum estimated water surface elevation was 8.2 feet NGVD at 1:15 am. The pump station would have flooded, but the maximum estimated water surface elevation would be 0.3 feet below the first pump control board and the batteries. If the first pump did fail, the remaining three pumps would have capacity for the remainder of the storm. At elevation 8.2 feet NGVD, the flooding would not extend outside the Dixon Landing Park.

A second alternative operation scenario was estimated assuming that the pump station would not fail during the February 3, 1998 storm. This assumed that the pump station would operate at the maximum estimated capacity of 150 cfs no matter how high the flooding reached. This would represent a case in which the station control system was flood protected. The estimated operation with the creek overflow and no pump station failure is shown in Figure 26. The maximum estimated water surface elevation was 9.8 feet NGVD (12.8 feet NAVD) at 1:30 am. The flood depth would reach 2.5 feet within the pump station. At elevation 9.8 feet NGVD, the flooding would extend outside the Dixon Landing Park. The flood depth would be approximately 1.2 feet at the lowest point on Jurgens Drive at Gingerwood Drive. The flood depth would be approximately 0.7 feet in the lowest areas of the apartment parking lots north of Dixon Landing Park.

**Historic Improvements and Studies**

The existing documents from City and District related to Berryessa Creek, Calera Creek, Lower Penitencia Creek, California Landing, and Jurgens Pump Station were reviewed to determine the sequence of construction, and the companies and agencies involved. The study scope of work did not include review of files or documents from other sources.

The normal permit or project approval process for construction projects varies depending on the type of project and the lead agency involved. Private projects including development grading and construction are reviewed and approved by the City as the lead agency. This includes City facilities such as roads, storm drains and pump stations which are constructed for dedication to the City. Private projects which include construction in a stream channel or grading within 50 feet of the stream bank require an additional permit from the District.

# California Landing
## Inflow, Outflow & Storage - No Creek Overflow

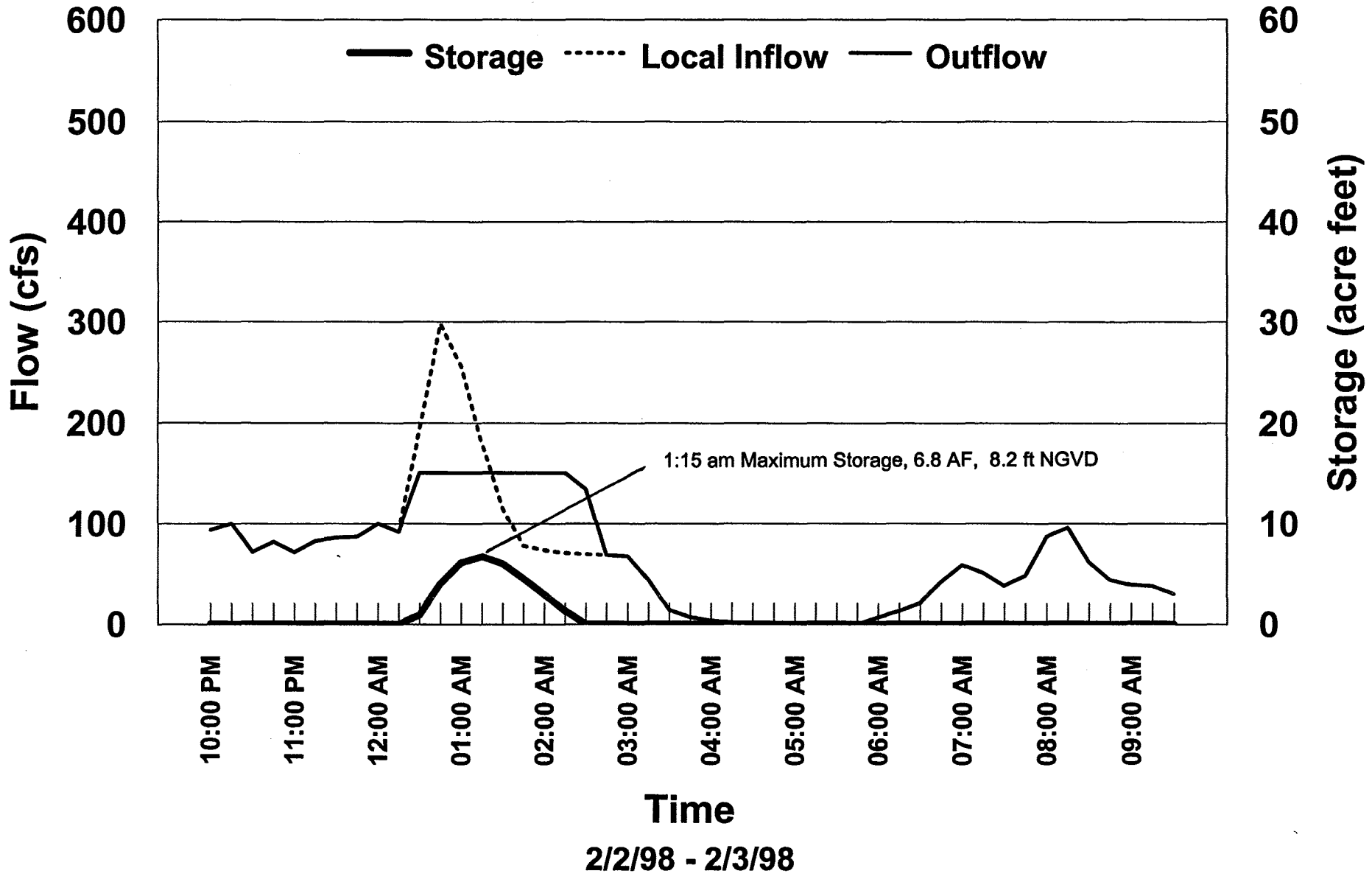



FIGURE 25

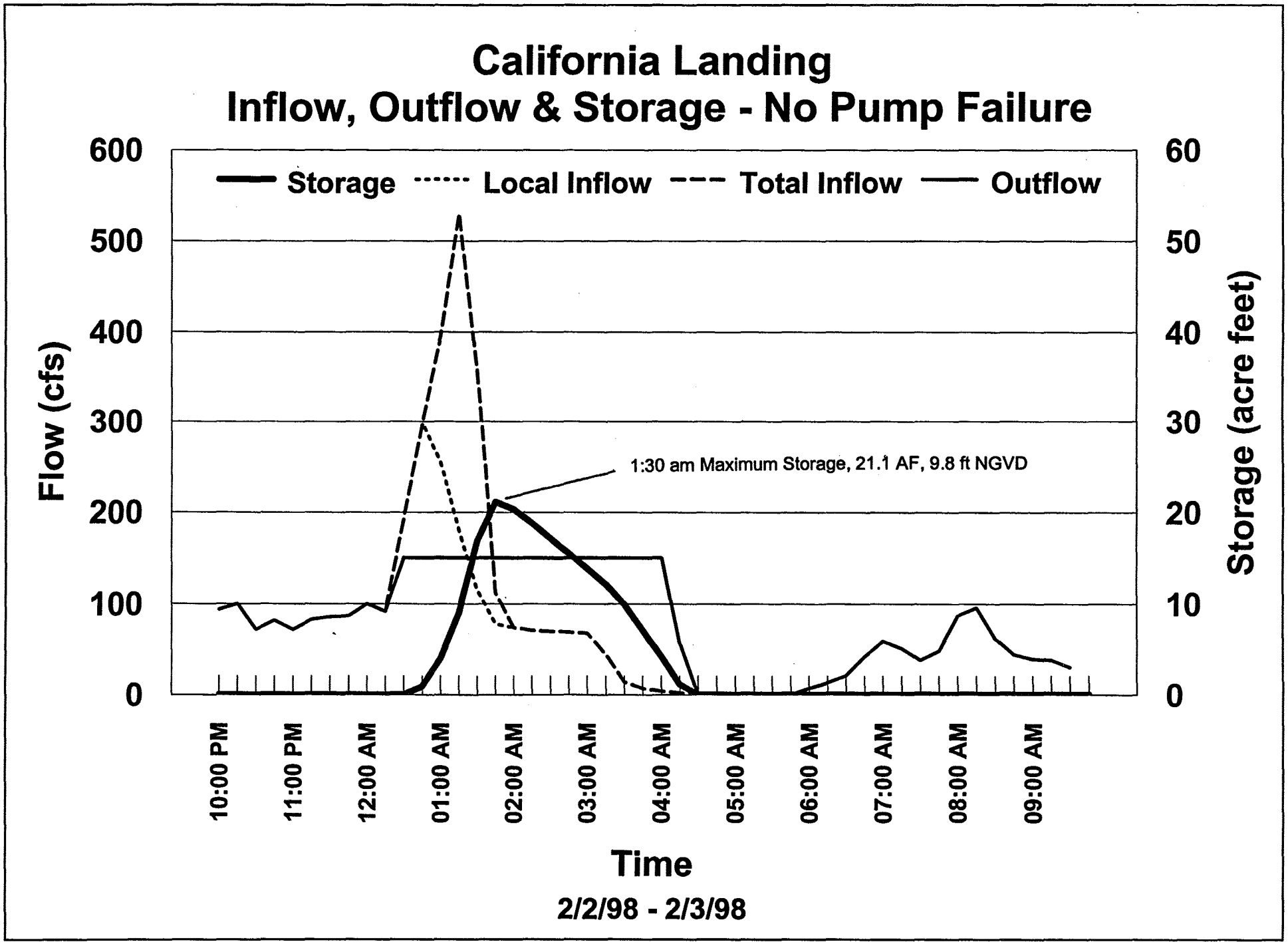
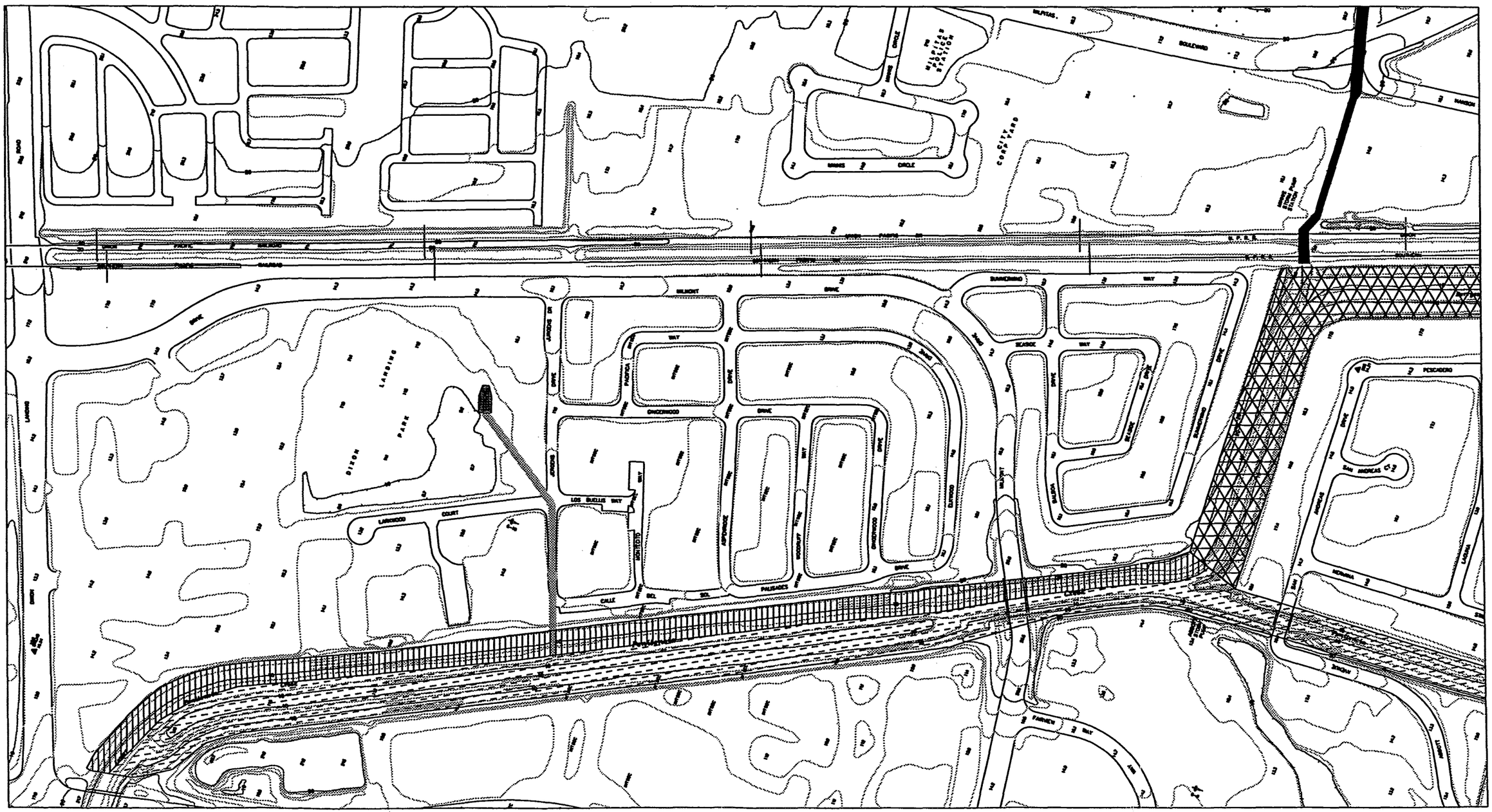

California Landing
Inflow, Outflow & Storage - No Pump Failure
Storage
Local Inflow
Total Inflow
Outflow
1:30 am Maximum Storage, 21.1 AF, 9.8 ft NGVD
Flow (cfs)
Storage (acre feet)
600
500
400
300
200
100
0
60
50
40
30
20
10
0
10:00 PM
11:00 PM
12:00 AM
01:00 AM
02:00 AM
03:00 AM
04:00 AM
05:00 AM
06:00 AM
07:00 AM
08:00 AM
09:00 AM
Time
2/2/98 - 2/3/98

FIGURE 26

| | | |
|---|---|---|
| | SCVWD - Berryessa Creek | Completed Feb 1977 |
| | Shapell - Calera Creek | Completed Dec 1980 |
| | Dixon Landing - Lower Penitencia Creek | Completed Dec 1983 (est) |
| | California Landing - Lower Penitencia Creek | Completed Dec 1989 (est) |
| | California Landing - Pump Station | As Built 4-01-91 |

# California Landing Area
# Channel Improvement Projects

1"=300'




FILE NAME:

Schaaf & Wheeler

City construction projects are reviewed and approved by the City as the lead agency. This includes facilities such as roads and storm drains funded by the City capital improvement programs. City projects which include construction in a stream channel or grading within 50 feet of the stream bank require a District permit.

District projects are reviewed and approved by the District as the lead agency. This includes channels, levees, and bridges. District projects which include construction in a City right of way, such as modifications of a City bridge, would require approval from the City.

All projects which require grading within the railroad right of way or modification of railroad facilities would require approval from the railroad. The railroad may require that construction be done by railroad staff where modification of railroad facilities is involved.

Existing Milpitas and District file documents were reviewed as part of the flooding evaluation for the February 3, 1998 storm. A summary of significant projects and studies is included below. The location of the channel improvement projects are shown in Figure 27. A detailed chronology of file documents is attached.

1976 Berryessa Creek Improvements

Berryessa Creek was improved by the District. The project extended from the Lower Penitencia Creek confluence upstream to Calaveras Boulevard. The project included widening the existing channel and construction of new levees. The design levee elevation at the Calera Creek confluence was 16.1 feet NGVD. The plans show the levees at the Calera Creek confluence extending to the SPRR fill, including fill in the low point which overflowed February 3, 1998. The project did not include modification of the SPRR or WPRR crossings at Calera Creek. The plans are signed as-built 5/28/77.

1979 Calera Creek Improvements

Calera Creek was improved by Shapell Industries for the Lindmuir development as a City project. The project obtained a District permit. The project extended from the Berryessa Creek confluence upstream to Milpitas Boulevard. The project included 700 feet of concrete lined channel and a double box culvert crossing at the SPRR and WPRR. No details were included for any modification of the Berryessa Creek levees at the confluence. The project was accepted by the City 1/22/80. The plans are signed as-built 2/19/82.

1983 Lower Penitencia Creek Improvements

Lower Penitencia Creek was improved by Cadillac Fairview for the Dixon Landing development as a City project. The project obtained a District permit. The project extended from Highway 880 upstream to the confluence with Berryessa Creek. The project included channelization of the existing creek and construction of the west levee for Lower Penitencia Creek.

1988 Lower Penitencia Creek Improvements

Lower Penitencia Creek east levee was improved by Kaufman & Broad for the California Landing development as a City project. The project obtained a District permit. The project extended from California Circle (400 feet upstream of Highway 880) upstream to the Berryessa Creek confluence near the southwest corner of the California Landing area. The project included construction of the east levee for Lower Penitencia Creek, landscaping and access road construction.

1989 California Landing Pump Station

The California Landing pump station (Jurgens Pump Station) was constructed by Kaufman & Broad for the California Landing development as a City project. The project obtained a District outfall permit. The project included construction of the storm water pump station in Dixon Landing Park, the outfall to Lower Penitencia Creek (Sunnyhill outfall), and initial phase of California Landing storm drain system.

1992 FEMA Flood Insurance Map Revision

FEMA issued a Letter of Map Revision (LOMR) for the California Landing area at the request of Bissell & Karn, engineer for Kaufman & Broad. The request was with the approval of the City of Milpitas. Copies of the request and LOMR were sent to the District. The LOMR removed the flood plain at elevation 10 feet NGVD in the northwestern portion of the California Landing area. Portions of Dixon Landing Park remain in the 100-year flood plain at elevation 7 feet NGVD (Dixon Lakes).

1994 FEMA Flood Insurance Restudy

Nolte and Associates, study contractor for FEMA restudy, identified levee elevations for Berryessa Creek would not meet FEMA levee freeboard criteria. The letter from the FEMA study contractor to the District identified low levee elevations for Berryessa Creek upstream of Calera Creek confluence. The low point at the Calera Creek confluence was not specifically identified.

1997 Berryessa Creek Levee Improvements

During the summer of 1997, the District completed remedial work to restore design levee elevations for Berryessa Creek.

1998 FEMA Revised Flood Insurance Rate Map

FEMA issued revised flood insurance rate map which included revised flood plain in California Landing area from 1992 LOMR.

1998 Calera Creek Elevation Data

Nolte and Associates documentation from FEMA restudy provided Calera Creek cross sections from Berryessa Creek upstream to Highway 680. Channel cross sections show FEMA 100-year water surface elevations and top of bank elevations.

**Summary and Conclusions**

1. The precipitation gauges in the San Jose/ Milpitas/Fremont area show relatively consistent storm 24-hour rainfalls for the February 3, 1998 storm, in the range of 2.5 to 3.0 inches. The exception is the Penitencia precipitation gauge which appears to be an anomaly.

2. Based on the rainfall statistics for the Milpitas gauge (which is within the watershed), the 1-hour, 2-hour, 3-hour, and 6-hour rainfall intensities are close to the 10-year frequency curve. The Curtner Ranch gauge intensities are closer to the 5-year frequency curve.

3. The month of January 1998 was very wet, with 6.5 inches of rainfall. And over 1.0 inches of rain occurred in the 5 days before the storm. The soils in the watershed would be very wet which would increase the potential runoff.

4. The storm hydrology reconstitution model estimated the peak flow rate in Berryessa Creek at approximately 3090 cfs. The estimated peak flow is greater than the 100-year flow rates from the flood insurance study data. The peak flow rate in the existing channels is limited by inflow capacities of the storm drain systems, and the channel capacities within the watershed.

5. The reconstitution estimated peak flow rate of 3090 cfs is below the District 1 percent design flow rate for the Berryessa Creek channel of 5600 cfs.

6. The high water mark elevation at the low point in the Berryessa Creek levee west of the SPRR was 13.6 feet NGVD. This is higher than the estimated flood insurance study 100-year flood elevation of 12.6 feet NGVD, but less than the District 100-year design elevation of 14.0 feet.

7. The hydraulic reconstitution model using the estimated peak flow rates for Lower Penitencia Creek and Berryessa Creek calculated the water surface elevation at the low point at the Calera Creek confluence to be 12.0 feet NGVD, 1.6 feet lower than the surveyed high water mark. The hydraulic model was based on the hydraulic model used for the channel design.

8. The surveyed high water mark at Berryessa Creek for the February 3, 1998 storm was less than the current channel design water surface elevation.

9. The overflow from Berryessa Creek flowed northward along the SPRR, between the railroad and the California Landing sound wall. Hydraulic pressure on the sound wall

washed out the soil under the sound wall to allow the flood water from Berryessa Creek into the California Landing area.

10. The combined inflows from the local drainage area and the overflow from Berryessa Creek exceeded the capacity of the Jurgens pump station at Dixon Landing Park. The pump station appears to have failed due to flooding of the control system. The pump station design did not consider overflows from the creek. Pump station and subdivision designs would normally only consider overflows from a stream channel where a specific problem had been identified.

11. Without the overflow from the creek, the pump station would have been able to remove the local area runoff with ponding in the park. The park was designed to act as a detention pond for the pump station. There would have been some flooding within the pump station. The flooding would not have extended outside the park.

12. The construction plans for the Berryessa Creek improvements in 1977 show the low point at the Calera Creek confluence was filled as part of the levee project. The levee design extended to the SPRR fill, which is lower than the Berryessa Creek levee. The SPRR crossing at Calera Creek was not included in the Berryessa Creek project.

13. The construction plans for the Calera Creek improvements in 1980 did not tie into the Berryessa Creek levees. The Calera Creek improvements were not designed to contain the Berryessa Creek design water surface elevation. The Calera Creek improvement plans were prepared as part of a development project for Shapell Industries. The plans were reviewed and approved by the City of Milpitas and District.

14. The 1988 improvement plans for California Landing show an existing elevation of 10.2 feet NGVD at the low point at the Calera Creek confluence.

15. The FEMA restudy for Berryessa Creek identified potential low areas in the levees. The District surveyed the levees and raised the levees to provide design freeboard. The low point in the Berryessa Creek levee at the Calera Creek confluence was not identified by the FEMA study contractor as a specific area which did not meet FEMA freeboard criteria.

# CHRONOLOGY OF HISTORIC IMPROVEMENTS

January 11, 1973 — District letter to City of Milpitas.
Letter commenting on draft EIR for Abel Street overhead. The District ". . . plans to realign, deepen, and widen the Berryessa channel ..."

January 23, 1973 — City of Milpitas Report
Environmental Impact Report (EIR) for Abel Street Overhead and Related Facilities.
Describes widening of Main Street and the construction of a new culvert at Calera Creek.
Calera Creek will be widened ultimately by the District.

September 6, 1973 — District Map and General Plan
SCVWD East Flood Control Zone E-1 Project 40018
Calera Creek from Berryessa Creek to 155 feet upstream of route 680
Realignment of Calera Creek to run adjacent to Jacklin Road, underneath North Main Street and SP/WP RRs to confluence with Berryessa Creek.
Plans show double box culvert under the two railroad tracks and an 'outlet confluence structure' apparently with floodwalls to elevation 16.0 downstream of the railroad. Culvert invert at elevation 6.4 at downstream.
Planning study - not 'as built'

February 20, 1975 — District Memo
" . . . investigating alternatives on Calera Creek between the Southern Pacific Railroad and Western Pacific Railroad and Main Street because Chappell (sic) is planning a development east of Main Street and because Milpitas is planning to rebuild the culvert on Main Street . . . . " "Since the District has no funds . . . City of Milpitas would have to come up with the funds . . . " "Regarding Chappell (sic), it would seem their development would cause increased flooding on the downstream property since there is no proper outfall and that their property should not be developed unless they can demonstrate that their development will not increase downstream flooding.. . ."

July 1, 1975 — District Report
Engineer's Report for Berryessa Creek Improvement
from Lower Penitencia Creek to Calaveras Boulevard
"The proposed improvements, when constructed, will prevent major flooding in the floodplain areas of Berryessa Creek between The Sinclair Freeway (Route 680) and Main Street and between Jacklin Road and Calaveras Boulevard."
The 100-year flood map did not show any area north of Jacklin Road. The engineering drawings showed levee construction similar to what exists today but plans provided no details on connection to Calera Creek.

July 1975 — District Report
Final EIR for Proposed Berryessa Creek Flood Control Project
from Lower Penitencia Creek confluence to Calaveras Boulevard
Prepared by Woodward-Clyde Consultants for Santa Clara Valley Water District
The 100-year flood map was same as in Engineer's Report, i.e., south of Jacklin Road, south of Calera Creek. The report describes City of Milpitas receiving initial flood hazard boundary maps from the Federal Emergency Management Agency (FEMA) in March 1974 which showed all land within city west of Interstate 680 to be flood prone. 'The waters which potentially could flood this land would come from Calera and Coyote Creeks, as well as Berryessa Creek."
Report described levee project with a substantial floodgate facility . . . at the confluence of the excavated channel and Calera Creek, so that local drainage can be released into the flood facility." There were no plans showing the 'floodgate facility" in the EIR or Engineer's Report.

The EIR also included the following section under the Hydrology Impacts section:

> "The improved channel will convey runoff somewhat more rapidly than the present channel. During periods of high flow this could cause some increase in the flooding downstream (i.e., below the point where Berryessa Creek meets with Lower Penitencia Creek). Because there is currently little development in this downstream area, neither the areal extent nor the severity of this additional increment in flooding has been computed in detail. However, the Water District believes that the potential increase in property damage would be minor. Subsequent improvement of downstream reaches will, of course, mitigate those problems. During periods of high stream flow in Berryessa Creek, all of the other creeks in the area will also be conveying high flows. The flow from Berryessa will undoubtedly raise the stage in Tularcitos and Calera Creeks and add to the load on Penitencia and Coyote Creeks. However, similar conditions have occurred for many years and must be expected to occur indefinitely, primarily because of the flat terrain. Hence, the interference of Berryessa Creek with other creeks will probably be only slightly increased by the proposed channel modifications.'

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| August 5, 1975 | Bissell and Karn Letter to City of Milpitas.<br>Summary of analysis on flooding impacts downstream of Shapell development for a 100-year flood downstream of the proposed double 10'x8' concrete box under N. Main Street to the WPRR. Evaluation assumes no improved outfall channel for Calera Creek downstream of WPRR.<br>" . . . improvements upstream of relocated North Main Street without the outfall channel will not significantly change the existing flooding conditions downstream." |
| **March 4, 1976** | District Construction Plans<br>SPRR and WPRR Bridges at Berryessa Creek, Milpitas<br>Project site covers where Berryessa Creek crosses RR tracks from the East, runs north along the west side of the tracks and then goes west.<br>As-builts 5/29/77 |
| **March 12, 1976** | District Map and Construction Plan<br>SCVWD Project # 4017, East Flood Control Zone<br>Berryessa Creek from Lower Penitencia Creek to Station 51+00 (just east of RR tracks)<br>Includes Calera Creek confluence on plan<br>Confluence detail shows Berryessa levees extending to SPRR. Levee profiles slope down to meet RR fill.<br>As-builts 5/28/77 |
| March 16, 1976 | District Memo<br>Agenda request for construction proposals for Berryessa Creek from Lower Penitencia Creek to Calaveras Boulevard.<br>" Authorized chairman to execute agreement with City of Milpitas which has agreed in principle to grant District $302,000."<br>Included estimated payment of $170,800 to WPRR for work related to railroad crossing. |
| May 4, 1976 | District awarded contract for construction of Berryessa Creek project. |
| January 11, 1977 | District memo.<br>Discussion of having developer (Chappell) (sic) construct the Calera Creek improvements from Berryessa Creek to Main Street. |
| January 24, 1977 | City of Milpitas Letter to District. |

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| | Transmitted California Environmental Quality Act (CEQA) document which addressed " . . . the widening of Calera Creek between Milpitas Boulevard and the Berryessa channel. . . " "Please advise... so that we may proceed with the design and construction . . . " |
| January 24, 1977 | District Memo<br>Discussion of City of Milpitas and developer investigating construction of Calera Creek between Main Street and Berryessa Creek.<br>"The project would be financed by development funds from Milpitas."<br>"They will investigate a couple of alternative plans for channel alignment and bridges with the SPRR and WPRR and then get back with us for further discussions." |
| February 25, 1977 | District accepts completed levee work and channel realignment work on Berryessa Creek between Lower Penitencia Creek and Calaveras Boulevard. |
| May 12, 1977 | City of Milpitas Letter to District.<br>"City of Milpitas is pursuing the construction of Calera Creek between Main Street and Berryessa Creek."<br>"The developer was not interested in pursuing design and construction at that time."<br>The City of Milpitas requested the District proceed with plans and contract construction. |
| July 20, 1977 | District Letter to City of Milpitas.<br>Letter described Calera Creek project as "New concrete box culverts . . . beneath the Western Pacific and Southern Pacific Railroad tracks and the confluence of Calera and Berryessa Creeks would be regraded.<br>The District did not have funds to finance construction. |
| August 4, 1977 | District Letter to City of Milpitas.<br>Discussion of cost review of SPRR crossing for Calera Creek.<br>"First, the existing railroad bridges are timber pile bridges that are probably more than 50 years old. Neither railroad company will allow us to modify these structures. The railroad engineers feel that the structural integrity of these bridges would be jeopardized."<br>"Second, the existing Southern Pacific bridge is below the one percent water surface elevation. Even if the bottom of this bridge was lowered by many feet, the water surface elevation would still be above the soffit of the bridge. The water surface is controlled by the depth of flow in Berryessa Creek." |
| November 4, 1977 | District Letter to City of Milpitas.<br>Transmitted draft agreement for District to plan, design, construct, and maintain the improvements to Calera Creek from Berryessa Creek confluence to Main Street.<br>Anticipated construction in August 1978. |
| December 13,1977 | City of Milpitas Improvement Plans<br>Milpitas Project 2-437<br>Jon Minnis Properties, Minnis Circle<br>14 lots adjacent to RR , North Milpitas Blvd & Minnis Circle<br>Includes off site storm plan, pumping station, and outfall Calera Creek<br>10 Sheets, up to sheet 6 marked as as-builts |
| January 27, 1978 | City of Milpitas Letter to District.<br>Response to District's November 4 letter.<br>The City of Milpitas had negotiated with developer for the construction of Calera Creek project. Did not pursue the draft agreement with District. |
| November 1, 1978 | FEMA Initial Community Coordination Meeting with City of Milpitas |

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| | Presented preliminary flood insurance study work maps. Work maps showed flooding on the California Landing site in the northwest quadrant as AH (a pending zone) to elevation 10.0 (NGVD). |
| **December 14, 1978** | City of Milpitas Improvement Plans<br>Milpitas Project 2-470<br>Calera Creek from Milpitas Blvd to Confluence w/ Berryessa Creek<br>For Shapell Industries of No. Calif.<br>Construction of Reinforced Concrete Channel approx 700' long, including box culverts under SPRR and WPRR.<br>Berryessa Creek levees or levee grading not shown.<br>As-builts 2/19/82 |
| January 22, 1980 | City of Milpitas Council Resolution<br>Milpitas Project 3224<br>Accepts Shapell Improvements for Calera Creek and approves reduction of penal sum of improvement bond. |
| **March 17, 1983** | City of Milpitas Improvement Plans<br>Milpitas Project 2-593<br>Dixon Landing Business Park<br>Improvement of Lower Penitencia Creek, Contract #5<br>Construction of levees and channelization of creek from approx. 100' east of Highway 17 (880) east to confluence with Berryessa Creek, approx 4700 ft<br>Engineer - Reimer & Associates |
| July 4, 1988 | FEMA Flood Insurance Rate Map (FIRM) Revision.<br>Map shows approximately 1/3 to ½ of California Landing site subject to flooding in northwest quadrant adjacent to Lower Penitencia Creek (AH Zone elevation 10 NGVD). |
| September 1988 | City of Milpitas Improvement Plans<br>Lower Penitencia Creek easterly levee from California Circle (450' east of Highway 17) to Berryessa Creek confluence.<br>Engineer - Reimer Associates<br>Not signed for approval, not marked as-built. |
| October 1988 | Bissell & Karn Report<br>California Landing Pumping Station Preliminary Phase Design Report<br>Preliminary design with site plans, specifications, and estimated costs<br>Engineer - Bissell & Karn |
| **November 22, 1988** | District Permit No. 88443<br>California Landing developer to construct east levee for Lower Penitencia Creek from Berryessa Creek to California Circle. |
| March 24, 1989 | District Letter to Kaufman & Broad<br>District accepts March 14 Reimer Associates plans for levee improvements. |
| March 6, 1989 | Bissell & Karn Map<br>Storm Drain, Sanitary Sewer & Water Master Plan<br>California Landing Development<br>Shows location of pump station and surrounding development<br>Engineer - Bissell & Karn |
| March 6, 1989 | Bissell & Karn Calculations<br>Pump Station & 72" outlet pipe calcs. |

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| | California Landing<br>6 pages of calcs and pump curves<br>Engineer - Bissell & Karn |
| October 1, 1989 | City of Milpitas Improvement Plan<br>Milpitas Project 2-752, Tract 8303<br>Project plans, including grading and utilites<br>Engineers - Bissell & Karn, Inc. |
| **October 1, 1989** | City of Milpitas Improvement Plans<br>Milpitas Project 2-756<br>Californaia Landing Pump Station<br>As Built 4/1/91<br>Engineers - Bissell & Karn |
| October 16, 1989 | City of Milpitas Improvement Plans<br>Milpitas Project 2-756<br>California Landing Pump Station Building & Entry Lattice<br>As-built - Electrical - 5 Sheets 7/20/90<br>Engine control schematic<br>Connection diagram (separate for each of the 4 engines)<br>Elec. Engineer - Enercon Engineering |
| December 19, 1989 | District Permit # 89426<br>Encroachment and construction for installation of 72" CMP outfall to Lower Penitencia Creek |
| December 31, 1989 | City of Milpitas Improvement Plans<br>Milpitas Project 2-728<br>NW Corner of the Intersection of No. Milpitas Blvd & Wilson Way<br>Plan and Profile for water , storm and sanitary sewer for a 96 unit apartment complex.<br>Engineer - Dillion Engineering<br>As-builts 12/31/89 |
| March 13, 1990 | City of Milpitas Letter to FEMA<br>Request for map revision for California Landing Development. |
| May 10, 1990 | District Letter to Bissell and Karn<br>California Landing Development<br>Transmitted District information in HEC hydraulic models for a Conditional Letter of Map Revision (CLOMR) application to FEMA.<br>Reference to Berryessa Creek construction in 1976. |
| September 19, 1990 | District Permit # 90436<br>Kaufman & Broad<br>Permit for Lower Penitencia Creek, improvement of west levee access road, grading adjacent to east levee, landscape side slope of east levee. |
| May 1991 | City of Milpitas Improvement Plan<br>Milpitas Project 2-794<br>Villas at California Landing, tracts # 8459, 8460, 8461, 8462<br>Minor grading changes revision 7-91<br>Shows area SW of Jurgens pump station<br>72" outlet to creek<br>Engineer - Bissell & Karn |

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| July 1, 1991 | FEMA Letter to City of Milpitas.<br>Regarding CLOMR application for California Landing.<br>"We believe that, if the proposed levee improvements . . . are constructed ... then the east levee will provide protection from the 100-year flood..." |
| **March 9, 1992** | FEMA Letter to City of Milpitas<br>Regarding request for FIRM revisions from Bissell & Karn<br>Letter of Map Revision (LOMR) for Lower Penitencia Creek levee improvements, storm drain outfall, and storm water pump station for Sunnyhill outfall channel.<br>FIRM revised to remove elevation 10 feet flooding in California Landing site.<br>Revised FIRM to show Dixon Lakes flooding at elevation 7 NGVD (local ponding areas in Dixon Park). |
| **May 2, 1994** | Nolte and Associates Letter to District.<br>Regarding levee freeboard profiles on Berryessa Creek.<br>Analysis indicated the leveed sections did not have minimum 3 feet freeboard required by FEMA. Data table shows 100-year water surface at elevation 12.43 feet and top of right levee at elevation 17.3 feet at station 661.6 (approximate location of Calera Creek confluence. At station 937.9, water surface is 12.82 feet, right levee at 14.0 feet. |
| December 11, 1996 | District Letter to City of Milpitas.<br>Regarding the proposed revisions to the FIRM for Berryessa and Calera Creeks.<br>District committed to restore Berryessa levees to As-Built condition.<br>Calera Creek would require a capital improvement to raise portions of the levees. |
| July 10, 1997 | FEMA Letter to City of Milpitas.<br>FEMA study contractor found that existing levees from Calera and Berryessa Creeks did not have required freeboard. Requests City of Milpitas submit appropriate FEMA forms for remedial levee work within 30 days. |
| **Summer 1997** | District completes remedial work to restore the As-Built grades to the Berryessa Creek levees. |
| **July 10, 1997** | FEMA FIRM Panel 060344 - 0001 Revised to Reflect LOMR<br>Shows only isolated flooding in Dixon Park Lakes at elevation 7 feet.<br>Shows 100-year water surface elevation between 12 and 13 feet at Calera Creek confluence (12.6 feet interpolated). |
| June 22, 1998 | FEMA FIRM Panel 060344 - 0001 Revised<br>Shows only isolated flooding in Dixon Park Lakes at elevation 7 feet.<br>Shows 100-year water surface elevation between 12 and 13 feet at Calera Creek confluence (12.6 feet interpolated). |
| January 20, 1998 | Nolte and Associates<br>Calera Creek Proposed Levee Limits<br>Shows Calera Creek 100-year freeboard daylight limits |
| January 29, 1998 | Nolte and Associates<br>Calera Creek cross sections, Sta 0+50 to 38+00<br>Cross sections show 100-year water surface elevation and top of bank. |